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# ARISTOTLE ON THE NECESSITY OF WHAT WE KNOW

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# ABSTRACT

Aristotle holds that we only have scientific knowledge of what cannot be otherwise. This may seem to imply that we only have scientific knowledge of changeless mathematical truths and other products of a priori reflection. Yet Aristotle is a pioneer of natural science, and exhorts us to study the natural world, which he himself characterizes as a realm of contingency, exception and chance. This dissertation asks why Aristotle holds the view that we only know what cannot be otherwise and whether he is able to reconcile this view with his engagement in and esteem for natural science, especially the study of animals. Aristotle holds that we only have scientific knowledge of necessities, I argue, as a way to reconcile his view that knowledge requires persisting agreement with the world and his view that scientific knowledge remains stable over time. Properly understood, Aristotle's claim does not pose a threat to the possibility of natural science but rather is at the heart of an attempt to explain how the study of nature is possible. We can have scientific knowledge about changeable and capricious things because the content of our knowledge strictly extends only to those facts about them that remain perpetually true on account of their essences.

# CHAPTER 1

# INTRODUCTION

## 1.1 Aristotle on what we know

Aristotle claims that anything that is known "cannot be otherwise,"[1] or is "necessary."[2] He frequently adds that the objects of knowledge are universal,[3] eternal,[4] and subject neither to generation nor corruption.[5] The person who has knowledge in an unqualified sense must grasp what she knows *as* necessary.[6] She must grasp the facts that constitute her knowledge as necessary truths that follow necessarily from the most fundamental truths, or "principles," of the domain to which her knowledge belongs.[7] This requires that she has analyzed the structure of what her knowledge is about "right down to its elements,"[8] and implies that the items of our knowledge can be represented as the premises and conclusions of deductive proofs[9] that articulate the structure of some genus or domain of study.[10]

Aristotle infers that there is strictly no knowledge of contingencies,[11] of what occurs by

1. *Post. An.* I.2, 71b.12, 15–16, I.4, 73a.21, I.6, 74b.6. Translations of Aristotle are my own except where noted. Translations listed in the bibliography have however been consulted and occasionally phrases are borrowed without further explicit attribution. *Epistēmē* and *epistasthai* are translated with "knowledge" and "know". On the translation of these terms, see section 1.2 below and the Appendix.
2. *Post. An.* I.33, 89a.10, I.4, 73a.22.
3. *Post. An.* I.31, 87b.38–39.
4. *Nic. Eth.* VI.3, 1139b.23. Cf. *Post. An.* I.8, 75b.22–24, I.31, 87b.28–39.
5. *Nic. Eth.* VI.3, 1139b.24.
6. *Post. An.* I.33, 89a.33–37.
7. *Post. An.* I.9, 75b.4–7.
8. *Phys.* I.1, 184a.14.
9. *Post. An.* I.2, 71b.16–23.
10. *Post. An.* I.10, 76b.13, I.28, 87a.38–87b.4.
11. *Post. An.* I.33, 88b.32–34.

chance,[12] of the corruptible and the perishable,[13] or of particulars at all.[14] Of particulars there is merely "perception,"[15] and of what can be otherwise there is no knowledge but only "belief."[16] Anyone who lacks a demonstrative proof of what they know from first principles or a grasp of its essence has knowledge only in a "sophistical"[17] or "accidental"[18] way.

Aristotle's reasons for these claims, which have been a sticking point for both historical[19] and contemporary readers,[20] are not easy to discern. The *Posterior Analytics*, especially the first book, develops these ideas by elaborating what is required of a proof so

12. *Post. An.* I.30, 87b.19.

13. *Post. An.* I.8, 75b.24–25, *Nic. Eth.* VI.3, 1139b.22–24.

14. *Post. An.* I.18, 81b.6–7, *Rhet.* I.2, 1356b.32–33. Cf. *Post. An.* I.31, 87b.28–39 and *Met.* Z.15, 1029b.27–1040a.5 (where, however, the point is limited to *sensible* particulars).

15. *Post. An.* I.18, 81b.6, I.33, 87b.29–30; cf. *Top.* II.8, 114a.23.

16. *Post. An.* I.33, 89a.30–35, *Met.* Z.15, 1039b.32–1040a.1.

17. *Post. An.* I.2, 71b.9–10.

18. *Post. An.* I.2, 71b.10, *Nic. Eth.* VI.3, 1139b.35.

19. Philosophers in the Jewish, Christian and Islamic traditions struggled with the consequences of these claims. Avicenna received censure for his claim that God knows particulars only "in a universal way," which al-Ghazālī deemed irreligious in *The Incoherence of the Philosophers* (Marmura 2000, 134; Marmura 1962, 299). Peter Adamson has argued that Avicenna's position was not a special theological doctrine but rather simply the application of a general Aristotelian theory of knowledge in the divine case: "the reason God does not 'know particulars' is very simple: there is no such thing as knowledge of particulars. This holds true for humans no less than for God" (Adamson 2005, 294). William of Auvergne struggled with the apparent consequence that God could not know the acts and prayers of individual people (Marenbon 1987, 113), while Henry of Ghent sought to explain the possibility of knowledge of a world that God could alter at will (Marenbon 1987, 148–49). Maimonides and Gersonides both sought to modify Avicenna's doctrine in ways that would render it religiously acceptable (Lim 2009).

20. The sorts of mundane contingencies that frequently serve as paradigms of knowledge in contemporary epistemology (that Jones has ten coins in his pocket, to use the famous example of Gettier 1963, 122) are apparently ruled out of court by Aristotle's claim that we only know necessities. Thus the detail of Aristotle's theory finds scarce mention in contemporary epistemology, even while elements of his general outlook and approach have enjoyed something of a renaissance in the literature of "virtue epistemology:" See especially Greco (2002), Sosa (2009), and Zagzebski (1996). On this further see the Appendix.

as to produce knowledge that lives up to these demanding criteria. In particular, Aristotle's *Posterior Analytics* relies heavily on the claim that what we know holds of *necessity*.[21] Yet it offers no argument for this claim that is not obviously circular.[22] Where we might expect to find one, Aristotle casually asserts that this is something everybody thinks.[23] This compounds the puzzle. As Jonathan Barnes has pointed out, it is factually false that Attic Greek speakers used "to know" and related expressions only to ascribe knowledge of necessarily true facts.[24] Alongside talk of knowledge of the Forms, the Platonic dialogues abound with mundane attributions of knowledge,[25] and attributions of knowledge of contingent facts are, unsurprisingly, routine in Greek oratory, history and tragedy.[26] Why,

21. *Posterior Analytics* I.4–6 presents an extended argument that the principles of demonstrations must hold of necessity, working from the premise that the objects of demonstrative knowledge, which are the conclusions of demonstrations, hold of necessity. I explore some parts of this argument in sections 2.3 and 3.3.

22. In defence of the claim that what we know holds of necessity, Aristotle does argue that "both those who do not have knowledge and those who have knowledge, the former think they are in such a state while the latter, those who know, [think they are in this state and] really are in such a state, with the result that what there is knowledge of in the unqualified sense cannot be otherwise" (καὶ γὰρ οἱ μὴ ἐπιστάμενοι καὶ οἱ ἐπιστάμενοι οἱ μὲν οἴονται αὐτοὶ οὕτως ἔχειν, οἱ δ' ἐπιστάμενοι καὶ ἔχουσιν, ὥστε οὗ ἁπλῶς ἔστιν ἐπιστήμη, τοῦτ' ἀδύνατον ἄλλως ἔχειν. Taking οἴονται to be implied before καὶ ἔχουσιν, *Post. An.* I.2, 71b.12–16). But this argument is clearly circular. Aristotle argues that both those who have knowledge and those who merely think they have knowledge at least *think* they are in this state, i.e., a state of grasping causes and knowing necessities. So, Aristotle concludes, it is generally agreed that we are in this state when we have knowledge. Yet if the hearer of this argument does not already accept that knowledge is of necessities, that person will find the claim that those who have knowledge "really are in such a state" plainly question-begging. That suggests that this argument is intended to elicit from his audience something that they will readily assent to on reflection, rather than to convince them of a claim that they in no way believed before.

23. *Post. An.* I.2, 71b.9, 71b.12–16, I.33, 89a.7–10; cf. *Post. An.* I.9, 76a.28–30, II.11, 94a.20.

24. Barnes (1993, 91).

25. Bolton (2012, 46–57) provides a number of examples from Plato illustrating this point.

26. See section 1.2 below.

then, does Aristotle hold this position?

To be sure, Aristotle's view belongs to a tradition. Parmenides's poem distinguishes two ways of "enquiry,"[27] a way of "conviction"[28] associated with "what is"[29] and a way of "opinion"[30] associated with what "is not and must needs not be."[31] The "being" that is associated with the way of conviction is said to be bound by "mighty Necessity,"[32] which causes it to "remain the same and in the same state."[33] The more immediate precedent is *Republic* V, where Plato famously argues that the type of thing we know must be different from the type of thing we opine. Since opinion is "fallible"[34] while knowledge is "free from error,"[35] Glaucon accedes that it would be impossible for the "object of knowledge"[36] to be the same as the "object of opinion,"[37] identifying the object of knowledge with "being,"[38] and the object opinion with "what has a share in both – in being and in not being."[39] Rather than reporting the views of ordinary Greek speakers when he says that "we think what we know cannot be otherwise," it is more likely, as commentators have pointed out,

27. διζήσιός, D 6.2=DK 2.2.

28. πειθοῦς, D 6.4=DK 2.4.

29. ὅπως ἐστίν, D 6.3=DK 2.3.

30. δόξας, D 8.56=DK 8.50.

31. οὐκ ἔστιν τε καὶ ὡς χρεών ἐστι μὴ εἶναι, D 6.5=DK 2.5.

32. κρατερὴ [...] ἀνάγκη, D 8.35–36=DK 8.29–30.

33. τωὐτόν τ᾽ ἐν τωὐτῷ τε μένον, D 8.33=DK 8.27. On John Palmer's interpretation, Parmenides' point in distinguishing the two paths is precisely to distinguish the necessary from the contingent, and thus to restrict inquiry to necessities. See Palmer (2009, 83–105 and 137–180).

34. ἀναμάρτητον, *Rep.* V, 477e.7.

35. μὴ ἀναμαρτήτῳ, *Rep.* V, 477e.7.

36. γνωστόν, *Rep.* V, 478a.11.

37. δοξαστὸν, *Rep.* V, 478a.12.

38. εἶναί, *Rep.* V, 478e.2 (implied by 478e.5); τῷ ὄντι, *Rep.* V, 478a.7.

39. τὸ ἀμφοτέρων μετέχον, τοῦ εἶναί τε καὶ μὴ εἶναι, *Rep.* V, 478e.1–2. See further my discussion and notes on p. 92.

that Aristotle is flagging his continuity with this tradition.[40]

Yet to point to a tradition is not to explain why Aristotle holds this view. First, we still need to ask why Aristotle accepts this piece of the tradition. Is there some traditional argument that Aristotle accepts? There is, further, a serious difficulty in seeing how Aristotle *could* accept this part of his tradition. In Plato, this division of objects precedes, and in part motivates, the famous image of a line dividing the intelligible from the sensible world, and the subsequent valorization of cognitive pursuits directed toward non-sensible, eternal objects (especially mathematics, philosophy, and the science Plato calls dialectic).[41] This is surely at least one of the things Aristotle is revolting *against* when he implores us not to restrict our inquiries to what is most "esteemed"[42] and "divine,"[43] urging us to attend also to the "humble,"[44] "perishable"[45] creatures of our own realm. Aristotle insists that knowledge of these creatures has a unique epistemic value of its own, harder to discern than that of the immortal gods and the heavenly bodies, but no less genuine. Whereas we only catch glimpses of divine and eternal substances,[46] we are able to know plants and animals "more fully"[47] thanks to our dwelling among them; this "provides recompense"[48]

40. Pasnau (2017, 3) puts the point starkly: "no conversation with an ordinary Athenian, no matter how one-sided, could plausibly have elicited the result that knowledge concerns a proposition that is necessary and one-sided." See also Broadie and Rowe (2002, 365), Detel (1993, 2:38) and, especially, Bolton (2012) who argues for the claim at length. Fine (2010, 344) argues, provocatively, that it is Aristotle's view, *rather* than Plato's, that is best described as a "Two Worlds Theory."

41. See *Rep.* VI, 511a–e. On why Plato takes mathematics to be so important to the education of the guardians, see Burnyeat (2000).

42. τιμίας, *Part. An.* I.5, 644b.24–25.

43. θείας, 644b.25.

44. ἀτιμοτέρων, *Part. An.* I.5, 645a.15.

45. φθαρτῶν, *Part. An.* I.5, 644b.28.

46. *Part. An.* I.5, 644b.34.

47. μᾶλλον, *Part. An.* I.5, 644a.1.

48. ἀντικαταλλάττεταί τι, *Part. An.* I.5, 645a.3–4.

for their humble nature to such an extent that it is they, and not the beings that occupy the eternal heavens, that "take the prize of knowledge (*epistēmē*)."[49] Here we may ask: How can knowledge of perishable creatures "take the prize" if there is, strictly, no knowledge of them at all? Does Aristotle, as some commentators have thought, simply renounce his commitment to the necessity of knowledge when he comes to study the natural world?[50]

I will argue that, far from being a piece of Platonic baggage that must be dispensed with in the context of natural science, Aristotle's claim that we only have knowledge of necessities is the crux of an attempt to explain how knowledge is possible in the natural and non-natural sciences alike. Aristotle follows a tradition in holding that *what* we know must be unchanging if our knowledge is to be stable and reliable. But rather than inferring, as he takes his predecessors to have done, that true knowledge is to be had only in those disciplines concerned with unchangeable objects, Aristotle gives a theory of truth and modality that allows necessities to pertain to perishable objects, and consequently allows for there to be genuine scientific knowledge of perishable nature. While Aristotle's view belongs to a tradition, then, he intends something significantly different in saying that we only know necessities than what the same words might mean in the mouth of a Plato or

49. λαμβάνει τὴν τῆς ἐπιστήμης ὑπεροχήν, *Part. An.* I.5, 645a.1–2. Lennox (2001, 174) calls this a "remarkable statement of Aristotle's empiricism." Even Simplicius, striving to assimilate Aristotle's philosophy to Platonism, cannot deny that Aristotle has a special interest in the natural world that Plato does not; he is especially concerned "not [...] to cut himself off from nature" and thus takes the converse approach to Plato, studying "even the things above nature according to their relation to nature," where "the divine Plato [...] examines natural things according as they participate in those things above nature." Simplicius *in Cat.* 6, 27–30. On this passage and its significance for neo-Platonic readings of Aristotle, see Gerson (2005, 6), from which this translation has been drawn and modified.

50. The classical statement of this position is Solmsen (1929, 143), who argued that the theory of demonstration, together with its requirement that *epistēmē* be of necessities, was in its initial form "*lautester Platonismus*," which however Aristotle eventually refined into a more distinctive theory in the *Prior Analytics*. Solmsen's developmental hypothesis is criticized in Ross (1949, 6–22), although Ross does not address Solmsen's specific claim that Aristotle's association of *epistēmē* with necessity in the *Posterior Analytics* is a Platonic holdover. See also Owen (1975).

a Parmenides. As is often the case, Aristotle re-interprets a traditional dictum, giving it a meaning that is continuous with that of his predecessors while inverting some aspects of its significance.

I will focus on the issue of the *necessity* of the object of knowledge, but this dissertation should be read as a part of a potentially larger project that asks why Aristotle takes knowledge to have any of the apparently demanding criteria cited above, and whether these are, for Aristotle, so demanding and restrictive as they first seem. My guiding questions will thus be: *On what grounds* does Aristotle hold that we only know necessities? *How* can he hold this, given his esteem for, and engagement in, natural science?

In the remainder of this introduction, I outline the main approaches taken to this problem in the literature. Most attempt to explain why Aristotle holds this view by explaining what Aristotle means by *epistēmē*, the word I am here translating as "knowledge." I will argue that while each of these proposals sheds a certain amount of light on what Aristotle means, none is sufficient to explain why Aristotle should restrict knowledge to necessary truths. This view cannot, I will argue, be reduced to a terminological thesis. The task of the remainder of this introduction is therefore primarily negative: To establish that Aristotle is making the type of claim that we should expect an argument for, rather than merely offering a clarification about how he intends to use the word "knowledge" or the sense of knowledge he means. I will then sketch what I take to be the main idea behind Aristotle's argument for his position, before giving a breakdown of the dissertation.

## 1.2 Previous approaches

The canonical statement of Aristotle's view occurs in *Posterior Analytics* I.2, where Aristotle makes the following introductory remark concerning his topic:

**T1** We think we know (*epistasthai*) each thing *simpliciter*, and not in the sophistical way, accidentally, when we think we are aware of the explanation on account of which the thing is so, that it is an explanation of that thing, and that this cannot be otherwise.[51]

Aristotle here lists the necessity of the object of knowledge as one of three conditions that we take to hold when we take ourselves to have knowledge in an unqualified sense, along with knowing the cause of what we know and knowing that this is the cause of what we know. He goes on to make clear that he means by the final condition that it is "that of which there is knowledge without qualification"[52] which "cannot be otherwise."[53] Given that Aristotle's view fits so poorly with actual Greek usage, some scholars have concluded that Aristotle makes a scope-switch fallacy here. Theodor Ebert takes Aristotle to fallaciously infer his claim from the fact that, necessarily, 'S knows $p$' implies '$p$', that is, to confuse

(i) Necessarily: If S knows that $p$, then $p$

with:

(ii) If S knows that $p$, then, necessarily $p$.[54]

It is plausibly true that we all think (i): (i) simply states that knowledge is *factive*, that if someone knows something, then that thing is true. If Aristotle fails to clearly perceive

51. Ἐπίστασθαι δὲ οἰόμεθ' ἕκαστον ἁπλῶς, ἀλλὰ μὴ τὸν σοφιστικὸν τρόπον τὸν κατὰ συμβεβηκός, ὅταν τήν τ' αἰτίαν οἰώμεθα γινώσκειν δι' ἣν τὸ πρᾶγμά ἐστιν, ὅτι ἐκείνου αἰτία ἐστί, καὶ μὴ ἐνδέχεσθαι τοῦτ' ἄλλως ἔχειν, *Post. An.* I.2, 71b.9–12.

52. οὗ ἁπλῶς ἔστιν ἐπιστήμη, *Post. An.* I.2, 71b.15.

53. ἀδύνατον ἄλλως ἔχειν, *Post. An.* I.2, 71b.16.

54. Ebert (1980, 89–90). In his first edition, Barnes (1975, 97) likewise considers it "quite conceivable that Aristotle was simply mistaken in his analysis," referring to this scope fallacy as "the mistake [...] made every five years in *Mind*." He is criticized for this in Burnyeat (1981, 108n.23) and takes a more sympathetic position in Barnes (1993, 91), citing Taylor (1990) approvingly.

the difference between (i) and (ii), he might then think (fallaciously) that he can appeal to the trivially true (i) in support of the much less trivial (ii).

As Ebert himself notes, such a fallacy would be a disaster for Aristotle, since so much of the theory of *epistēmē* in *Posterior Analytics* I depends on the claim that *epistēmē* is of necessities.[55] For that reason, it would be rash to adopt such an interpretation without first investigating the reasons Aristotle could have for his position. And in fact, the observation that certain uses of the Greek words *epistasthai* and *epistēmē* do not fit Aristotle's description does not show that Aristotle must have made a fallacy of this sort. For, as Barnes points out, even in ordinary Greek *epistēmē* is used in a variety of contexts and senses. Even if Aristotle's claim does not capture "every legitimate use of the Greek words,"[56] he may nevertheless be making a trivial or immediate claim about a *specific sense* of *epistēmē*. Aristotle, after all, speaks explicitly of knowledge "simpliciter"[57] in *Posterior Analytics* I.2. This suggests that Aristotle may be using *epistasthai* and *epistēmē* in a restricted or even partially stipulative sense.[58]

Such an observation forms the basis for most modern approaches to the problem. Ross (1949), in his groundbreaking commentary on Aristotle's *Prior and Posterior Analytics*,

55. Ebert (1980, 90).

56. Barnes (1993, 91).

57. ἁπλῶς, *Post. An.* I.2, 71b.9.

58. Aristotle's usage cannot be *wholly* stipulative – it cannot be like when he says he will use the word "cloak" to denote the compound of pale and human (*Met.* Z.4, 1029b.27–28) – otherwise there would be no "we" who think this; Aristotle would have no one to include in his group but himself. But it may still be that Aristotle is using *epistasthai* with a semi-technical meaning, as some contemporary philosophers do when they "define" terms like "reason," "justification," and "intention." Such definitions are not supposed to replicate the dictionary definitions of these terms; they are defined in a way that supports certain theoretical purposes of the philosopher defining them. Nevertheless, such definitions are still meant to capture or at least reflect core aspects of their ordinary meaning. It remains a possibility that Aristotle is "defining" *epistasthai* in this way, or else that he is referring to a specifically philosophical, demanding or scientific notion of knowledge, to be distinguished from the everyday sort.

claims that

> As the *Prior Analytics* present Aristotle's theory of the syllogism, the *Posterior Analytics* present his theory of scientific knowledge. This, rather than 'knowledge' simply, is the right rendering of his word ἐπιστήμη, for while he would not deny that individual facts may be known, he maintains that ἐπιστήμη is of the universal.[59]

Ross's translation of *epistēmē* as "scientific knowledge" is still standard in much of the secondary literature.[60] By qualifying "knowledge" with "scientific," part of what Ross and others aim to convey is that Aristotle does not mean to be speaking about everything that we might be ready to call "knowledge." What Aristotle refers to simply as *epistēmē* is often what he more carefully describes as *epistēmē* "without qualification"[61] in T1: Knowledge in the *truest* sense, knowledge that falls short in no way that would make the attribution of it to someone merely partial or half-hearted. Thus, when Aristotle goes on to say that *epistēmē* is of necessities, he does not mean that it can never be at least loosely true to say of anyone that they have *epistēmē* of something particular or even contingently true. He means that such an attribution will not count as knowledge in the most strict and demanding sense.[62]

It is true that Aristotle takes the relevant type of knowledge the be that of people who have *studied* something and *investigated* a certain discipline. In that respect, it is

59. Ross (1949, 51).

60. McKirahan (1992), Goldin (1996) and Bronstein (2016) all select this translation in their books on the *Posterior Analytics*.

61. ἁπλῶς, *Post. An.* I.2, 71b.9.

62. Cf. Taylor (1990, 116, 122) and Barnes (1993, 91). It would be an exaggeration, however, to say that Aristotle is describing "something that hardly anyone has ever had, in any domain" (Pasnau 2013, 991). Aristotle's use of a present-general time clause in T1 suggests that he takes this demanding condition to be achieved with a reasonable degree of regularity.

correct to describe Aristotle's topic in the *Posterior Analytics* as "scientific" knowledge, and I will make use of this description myself in what follows. Nevertheless, we should be wary of two respects in which this translation can be misleading. The first is that it may lead us to import our own connotations of institutional knowledge, or knowledge produced by experiment, both of which did not exist for Aristotle. Understood in the appropriate way, "scientific knowledge" here is *almost* a pleonasm. Unqualified *epistēmē* is *scientific* only if "science" is heard in the sense of the Latin *scientia*. The Latin term has the right connotations in turn partly because it is was the standard scholastic rendering of *epistēmē*. We are reading too much into the word "science" here if we understand it to mean much more than "systematic disciplinary knowledge." We might equally well call Aristotle's topic "epistemic knowledge."

Nevertheless, the reduplication is not redundant if it serves to remind us that Aristotle means to be speaking of knowledge in the truest or most proper sense, with the implication that non-systematic, non-disciplinary kinds of knowledge are knowledge only in a looser sense of the term. By the same token, "scientific knowledge" may be misleading as a translation if it is taken to suggest that Aristotle is making a claim that bears in no way on knowledge in the looser senses. This is false: Aristotle's claim implies that knowledge of anything which falls short of necessity is only knowledge in a loose or "qualified" sense.[63] This is still a surprising claim, and so Aristotle's claim remains a philosophical one in need of defence, not merely a terminological stipulation or clarification.

Ross himself takes Aristotle's topic to be still narrower than this. He adds that in *Posterior Analytics* I, where Aristotle makes most of his claims concerning the necessity of the objects of *epistēmē*, it "might almost be said that Aristotle identifies science with

63. Frede (1996, 157–8) puts the point too strongly when he says that Aristotle is an "extreme rationalist" who holds that we have knowledge of contingencies only in a "debased" sense, but he is right to emphasize that Aristotle's claim is not neutral with respect to knowledge in the ordinary sense.

mathematics."[64] He does not present this explicitly as an explanation of Aristotle's claim that what we know holds of necessity, but if it is true that Aristotle intends in the *Posterior Analytics* to be speaking only of the knowledge that a mathematician has in her capacity as such, then we have ready to hand an explanation for why Aristotle takes *epistēmē* to be of necessities. Aristotle would simply be registering the fact that mathematical truths are necessities, something which many philosophers would readily assent to today.[65]

The postulation that Aristotle is concerned only, or primarily, with mathematics is found already in Robert Grosseteste's c. 1170 commentary on the *Posterior Analytics*,[66] and is defended by a number of more recent scholars.[67] Yet there is strong reason to doubt that Aristotle's topic is this narrow. This type of reading relies heavily on the observation that most of Aristotle's arguments in the first book of the *Posterior Analytics* are drawn from mathematical sciences.[68] But Aristotle's examples in the first book are not

64. Ross (1949, 75).

65. This view has remained orthodoxy even as logicism, the view that mathematical truths are *analytically* necessary, has lost many of its defenders (but see Wright 1983), and even while the a priori status of mathematics has been challenged, e.g. by Williamson (2007) and Casullo (2003). The view that (some) mathematical truths are contingent is however defended by Quine (1951) and, more recently, Field (1980).

66. *in Post. An.*, cap. 2.14: "Knowledge in the most proper sense, however, is comprehension of those things which are only in one state, and it is in this way that people have knowledge in mathematics. [*Dicitur etiam scientia magis proprie comprehensio veritatis eorum que semper uno modo se habent, et sic sciunt in mathematicis.*]" (2.14–16). Grosseteste contrasts this type of knowledge, which he identifies with Aristotle's ἐπιστήμη ἁπλῶς in *Post. An.* I.2, with knowledge of nature, which includes things that occur always or for the most part, and knowledge in the most general sense, which includes "erratic contingencies [*contingentia erratica*]" (2.11).

67. Especially Grote (1872, 578), Mansion (1976, 158–9) and von Fritz (1955, 43). See also Smith (1978) and Wians (1996).

68. This is explicitly the reasoning adopted in Wians (1996), who examines the examples more carefully than earlier scholars; Kullman (1981) and Ferejohn (1991, 117) also count examples but do not arrive at Ross's conclusion.

exclusively mathematical,[69] and in the second book of the *Posterior Analytics*, Aristotle draws freely from studies as diverse as history,[70] medicine,[71] botany[72] and meteorology,[73] to take a few examples.[74] Aristotle's wording, furthermore, consistently suggests that he wishes for his theory to be maximally encompassing: He clarifies that the opening thesis of the *Posterior Analytics*, that teaching and learning rely on prior knowledge, holds "in the mathematical and non-mathematical arts" alike, and when he claims in *Posterior Analytics* I.18 that all scientific knowledge relies on perception, he explicitly clarifies that this holds of the mathematical sciences too, *as one special case*, implying that scientific knowledge

69. Humans being animals at I.4, 73a.30–31, a white thing walking or being educated at I.4, 73b.4–7, an animal being sacrificed at I.4, 7b.14–16, eclipse of the moon at I.8, 75b.33–38, hot and cold at *Post. An.* I.10, 76b.18–19, Callias being human (in connection with the principle of non-contradiction) at I.11, 77a.15–18, walls not breathing at I.13, 78b.13–28, a human being white at I.19, 81b.25–29, a log being white at I.22, 83a.5–14, Callias, human and two-footed animal at I.22, 83b.3–5, coming to pay back money at I.24, 85a.30–32, borrowing money from a rich man at I.34, 89b.13–14, two people having a common enemy at 89b.14. Compare Barnes (1969, 70) and Kullman (1981). I exclude here examples where a comparison is made with mathematics and examples drawn from astronomy, harmonics and optics, which Aristotle sometimes treats as mathematical sciences. It would not be correct to say that the mathematical examples are the ones meant "seriously" or "in earnest:" See the painstaking study of examples by Wians (1996).

70. *Post. An.* II.11, 94a.36–94b.8.

71. *Post. An.* II.11, 94b.8–26.

72. *Post. An.* II.16, 98b.1–16.

73. *Post. An.* II.8, 94b.7–14, *Post. An.* II.15, 98a.30–34.

74. Ross concludes that the second book of the *Posterior Analytics* was originally a separate work, with a different focus and doctrine. Yet more recent scholarship has revealed a greater unity of the first and second book than Ross recognized, casting doubt on the viability of taking the second book to be an independent work: See especially Bronstein (2016). If there is a shift in focus from the first to the second book, it is a shift from scientific knowledge conceived as a static mental state to the process of scientific knowledge acquisition, rather than a shift in the types of sciences under consideration.

itself includes more than just mathematics even in this context.[75]

Not all traditional commentators took Aristotle's topic to be so narrow. Aquinas takes Aristotle's *Posterior Analytics* to be a study of the type of knowledge (*scientia*) we have of anything when we "apprehend its truth perfectly."[76] Aquinas argues that to perfectly apprehend the truth of something is to know it "in itself."[77] The contrast case is knowing something "in something else,"[78] in the sense of knowing an effect in which the cause inheres, a subject in which a property inheres, or principles of an argument in which a conclusion inheres.[79] To know, say, Corsicus is coming because we see a person coming and the person coming is as a matter of fact Corsicus, without knowing that this person is Corsicus, is to know that Corsicus is coming only "accidentally"[80] and thus not "unqualifiedly."[81] Likewise, when we know the effect of something without knowing its cause, we have imperfect knowledge *even of this effect*:[82] Only when we know a thing's causes may we be said to know *it* strictly rather than something else that it is a manifestation of, and only then can our knowledge of *it* be said to be perfect.

Aquinas makes clear that he takes the causes at issue to include both material and

75. Further, as a number of commentators have argued, Aristotle's demonstrative theory provides a poor model for Greek mathematics, which relied heavily on the use of geometrical construction and employed syllogistic argument only rarely; conversely, it captures elements of Aristotle's practice in the biological sciences better than early scholars like Ross recognized. That would make it surprising if Aristotle's *focus* were mathematics. On the poor fit with Greek mathematics see Mueller (1974). The literature on the applicability of Aristotle's demonstrative theory to biology is vast: Some landmarks are Gotthelf (1987), Bolton (1987), Kullmann (1974), and Lennox (1987). Some of these are discussed in chapter five.

76. *perfecte apprehendere veritatem ipsius*, *Exp. Post.* lib. 1 l. 4 n. 5.

77. *in seipso*, *Exp. Post.* lib. 1 l. 4 n. 4.

78. *in alio*, *Exp. Post.* lib. 1 l. 4 n. 4.

79. *Exp. Post.* lib. 1 l. 4 n. 4.

80. *secundum quid*, *Exp. Post.* lib. 1 l. 4 n. 4.

81. *simpliciter*, *Exp. Post.* lib. 1 l. 4 n. 4.

82. *Exp. Post.* lib. 1 l. 4 n. 4.

efficient causation, illustrating these with the decidedly non-mathematical paradigms of "water is made hot in virtue of fire"[83] and "a body is colored because its surface is the subject of color."[84] Mathematics thus has no privileged status when it comes to the type of knowledge he takes Aristotle to be discussing. It is one discipline among others in which we know things through their causes and thus in themselves.

Yet while this interpretation avoids the undesirable consequences of Ross's restriction of Aristotle's claim to mathematical knowledge, its prospects for explaining why Aristotle takes such knowledge to be of necessities are correspondingly more limited. Aquinas holds that the necessity of its object is part of the definition of this type of knowledge because perfect knowledge is "certain knowledge of a thing,"[85] and "it is not possible to know what can be otherwise with certainty."[86] But, at least on the face of it, this is false. I may know a necessarily true theorem of mathematics, say the 2R theorem,[87] on the basis of testimony. The theorem is, as it turns out, a necessary truth, but if I know it on the basis of a report that I take to be of questionable reliability, I will not know it with complete certainty. The content of my knowledge is a necessity, but that does not automatically grant me complete certainty of it. Conversely, it is not clear why I cannot have complete certainty that a contingent state of affairs holds, and be justified in so having it. On the face of it, the certainty of my mental state and the necessity of what I know are simply orthogonal: The latter concerns its content, the former the attitude I take towards that

83. *Exp. Post.* lib. 1 l. 10 n. 2.

84. *Exp. Post.* lib. 1 l. 10 n. 2.

85. *certa cognitio rei*, *Exp. Post.* lib. 1 l. 4 n. 5.

86. *quod autem contingit aliter se habere, non potest aliquis per certitudinem cognoscere*, *Exp. Post.* lib. 1 l. 4 n. 5. See however Stump (1991), who convincingly argues that this certainty is not secured by an antecedent certainty in demonstrative principles. See also Kretzmann (1991). Al-Farābī also places emphasis on the requirement that knowledge of the best sort be certain: See Black (2006).

87. That is, the theorem that the internal angles of a triangle have the same angle sum as the angle sum of two right angles.

content. Even if Aristotle takes *epistēmē* to require certainty, then, it is not clear why this should imply that it is only of necessities.

More recent scholars have questioned the claim that Aristotle attempts to derive the necessity of *epistēmē* from any such requirement that *epistēmē* be certain, pointing out that Aristotle's principal preoccupation in the *Posterior Analytics* lies rather with *explanation*.[88] A demonstration, the type of proof that Aristotle takes to provide *epistēmē*, is required to be *explanatory* of its conclusion,[89] and this requirement is used heavily in elaborating the details of the theory of demonstration, while any requirement that we be certain of the conclusion, if present at all, bears little weight.[90] This leads Aryeh Kosman to translate *epistēmē* as "understanding" rather than "knowledge." Myles Burnyeat follows Kosman, arguing more explicitly that a translation of "understanding" for *epistēmē* may help to explain what can seem like queer features of Aristotle's theory and is less misleading for a contemporary audience.[91] I raise some doubts about the latter claim and discuss the issue of translation in its own right in the Appendix; here, I will focus more narrowly on whether the assumption that Aristotle is talking about understanding rather than knowledge helps to explain why Aristotle takes *epistēmē* to be of necessities.

Both Kosman and Burnyeat claim it does. Kosman argues on Aristotle's behalf that the requirement that *epistēmē* satisfy the need for explanation implies that its object is a

88. Kosman (2013a, 83) concludes that "Aristotle's requirement of necessity in scientific understanding does not therefore reflect a theory according to which, for the sake of certainty, only the necessary can be the object of proper knowledge," but rather "a theory according to which necessity is a feature of explanation, since successfully to explain something is to show why it must be so." See also Kosman (2013b, 10). He is followed in this by Burnyeat (1981, 102).

89. See T1 and *Post. An.* I.2, 71b.16–19. For reasons to translate αἰτία as "explanation" rather than "cause," see Barnes (1993, 90).

90. The closest we get is at 72b.3–4, where Aristotle claims that the person in possession of unqualified *epistēmē* is "incapable of being persuaded otherwise" (ἀμετάπειστον). It is notable that little use is made of this condition in what follows.

91. Burnyeat (1981).

necessity:

> We say we have understood something when we think we know (and therefore can reveal) why it must be the case that it is so. There is not yet understanding of such a thing being the case as long as we have only shown that it might be the case; for we could still ask, why, given that it doesn't have to be the case, is it the case? That question, which is precisely the demand for explanation, will be answered only when we recognize that given these and these causes, it must result that such and such is the case. The explanatory demand, in other words, is fully satisfied and brought to rest only by the invocation of necessity.[92]

To understand something, Kosman claims here, is to grasp an explanation for it. And to grasp an explanation is *ipso facto* to grasp why it must be so. No explanation satisfies the "explanatory demand"[93] unless it thus shows the thing to be *necessary*. Kosman concludes that for this reason the object of *epistēmē*, understanding, must be a necessity.

We may grant Kosman that there is a sense in which, when one understands something, one thinks that it "must" be so. But we should be cautious in drawing the conclusion that understanding is of necessities in the sense that Aristotle takes *epistēmē* to be of necessities. Aristotle takes *epistēmē* to be of necessities in the sense that he takes anything of which we have *epistēmē* to be a *necessary truth*.[94] But when we say that we think what we understand "must" be so, it is not clear that we are ascribing a necessity to the

92. Kosman (2013a, 83).

93. Kosman (2013a, 83).

94. This is not unambiguously clear in T1: See Angioni (2016), who argues for a reading of that text which takes the necessity to be *that* the explanation applies to the given explanandum rather than that the thing known is necessary. Aristotle however makes clear that it is the truth of the thing known that is necessary at *Post. An.* I.33, 88b.32–33: "There are some things which are true and are so, but which can be otherwise. It is clear that there is no knowledge concerning these." See also *Post. An.* I.6, 75a.1–17. On this see further Fine (2010).

*object* of our understanding, the thing we understand. Kosman's own formulation in the passage quoted in fact suggests otherwise: "*given* these and these causes, it must result that such and such is the case."[95] That suggests that what we take to be necessary when we understand something is not the truth of the thing that we understand, but the inference from what we take to be the explanans to the explanandum. In other words, when we take ourselves to understand $F$, we plausibly take it to be necessary that $E \Rightarrow F$, where $E$ is the explanation we grasp. It does not follow, as Aristotle claims, that we take $F$ to be necessary.[96]

I might understand, for instance, why a certain vase broke: Because it was pushed and nothing prevented it from hitting the ground with sufficient force to break. I thereby understand why the vase fell. And I may be said to understand why the vase *must have fallen*, perhaps, in the sense that I understand that these conditions are *sufficient* for the vase breaking. My understanding of why the vase broke is connected with a grasp of the fact that it would have been impossible for the vase not to break because it was pushed and nothing broke its fall. So plausibly I think that *given that it was pushed and nothing prevented it from falling to the ground with sufficient force to break*, it must have broken. But none of that shows that the *explanandum*, that the vase broke, is a necessary truth.

95. Kosman (2013a, 83). My emphasis.

96. A plausible alternative view would be that the "must" expressed when we say something "must" be so because we understand it is Kratzer's "epistemic must," as when we say that someone must be home by now. See Kratzer (1977). Here the "must" expresses, on Kratzer's widely accepted analysis, that we take the sum total of our evidence to imply something. That also does not imply that what we understand is a necessary truth. Furthermore, if this is what the "must" of understanding expresses, understanding is not distinct from knowledge in this respect: Trivially, what we know "must" be true in the sense that the sum total of our knowledge implies it, since it is itself included in the sum total of what we know.

The vase may well not have been pushed, and thereby stayed intact.[97]

Myles Burnyeat follows Kosman in arguing that *epistēmē* means understanding, and likewise suggests that this helps us to understand Aristotle's necessity claim. Like Kosman, he argues that the conditions laid out at the start in T1 would be a more reasonable set of conditions to place on understanding, since "explanation and understanding go together in a way that explanation and knowledge do not."[98] He however offers a different explanation for why it is then natural for Aristotle to take understanding to be of necessities. According to Burnyeat, Aristotle has in mind specifically the type of explanation we possess in

97. Some contemporary philosophers have argued that *what* we understand, and not only the connection between explanans and explanandum, must also be a necessity. We find a version of this view in Dasgupta (2014, 4–5), who considers the sort of understanding children are after when they ask why things are so:

> What would answer the child's question as to why there is a mountain here? [...] A natural thought is that to answer the child's question one must (at a minimum) explain why there had to be a mountain here. Anything less than this (the thought is) will result in the child wondering why the world happened to turn out the way it did. So one might think that to answer the child's question of why F obtains one must state some necessary facts that ground F.

Answers to the question, "why does F obtain?," where this is asked out of a naive desire to understand, Dasgupta claims, only satisfy this desire if they help us to see why the world didn't just happen to turn out such that F obtains. Dasgupta infers that they must help us see why it *must be the case* that F in the sense that there is no genuine possibility that not F. Yet it is not clear why we should think that the standards for a satisfying explanation need be so high. There are ways of showing that the world did not just happen to turn out such that F obtains that do not consist in showing that no possible alternative exists. The demand to show that the world doesn't "just happen" to be such that F is only a demand to show that F's occurrence is not *arbitrary*, not a demand to rule out *every metaphysically possible alternative* in which F fails to occur. The two coincide for Dasgupta because he is aiming to rehabilitate Spinoza's necessitarianism: He holds that anything which actually is so is, ultimately, necessarily so, and hence to understand anything fully is to know its necessity (cf. Spinoza, *Ethics* Book II, P44 *dem.*). Aristotle on the other hand is not a modal determinist: He holds that some things occur which might have not occurred (*Post. An.* I.33, 89b.32–33). Dasgupta does not make clear why someone who is not a modal determinist should take understanding something fully to require locating a necessary truth.

98. Burnyeat (1981, 102). I discuss Burnyeat's proposal in greater detail in the Appendix.

science.[99] The object of *epistēmē* is thus "what gets explained in science,"[100] because Aristotle is talking specifically about the type of understanding that scientists have in their capacity as such. And Aristotle furthermore "sides with those modern philosophers of science who hold that scientific explanation is in the first instance explanation of generalities (laws) rather than the explanation of particular events."[101] Since scientific laws express "necessary connections in nature," it is natural for Aristotle to hold, according to Burnyeat, that *epistēmē* is of necessities.[102]

Burnyeat argues, first, that since *epistēmē* is of what gets explained in science, it is of general laws, and second, that because *epistēmē* is of general laws, it is therefore of things that hold of necessity. Above I expressed some misgivings about reading too much into the sense in which Aristotelian *epistēmē* is "scientific" knowledge. But even leaving these misgivings aside, we may still question both these inferences. Regarding the first, we may ask: Don't scientists also provide explanations of contingent phenomena on the basis of what they know, like the eruption of a certain volcano, or, to use Aristotle's own example, the seasonal flooding of the Nile? Why should this not count as part of what they understand in the capacity of scientists?

Regarding the second, we may point out that even if we grant that the objects of *epistēmē* are scientific generalizations, it does not follow that they are necessities. There is space between "lawlike regularities" and "necessary connections." For not all generalizations that scientists study are exceptionless and thus necessary. Scientists of "soft" sciences like biology, in particular, may appeal to explanatory connections that permit of exceptions. Aristotle himself does so in his biology: After laying down in the *Parts of Animals* that fish are sawtoothed, he adds "virtually all, since one small kind is not of this sort, viz.

99. Burnyeat (1981, 109).
100. Burnyeat (1981, 109).
101. Burnyeat (1981, 109).
102. Burnyeat (1981, 110).

the one called parrotfish."[103] Despite the exception of the parrotfish, we would surely by Aristotle's lights be explaining something if we pointed to any other type of fish and cited its being a fish as an explanation for it being sawtoothed. Explanatory regularities can thus for Aristotle have exceptions;[104] this at least on the face of it implies that they need not express "necessary connections."[105] Thus if Burnyeat is to avoid falling back into claiming, as Ross does, that Aristotle has only sciences like mathematics in mind, it is not clear how his appeal to scientific laws helps to explain their necessity.[106]

A different and in many ways more helpful approach is taken by Lesher (2001), who looks to the usage of the term *epistēmē* and its cognates before Aristotle in an attempt to explain the pecularities of Aristotle's theory. In their earliest extant usages, these terms and their cognates are used to ascribe practical abilities, often with a physical component. In Homer, *epistasthai* generally refers to expert mastery of practical skills, such as making war, fashioning ornaments or throwing the javelin.[107] Its typical usage is with a complementary infinitive, the ability to perform or effect which it ascribes. The connection with ability is

103. *Part. An.* III.7, 675a.1–2. Trans. Lennox.

104. Aristotle himself makes this point in *Met.* E.2, 1027a.16–19, when he clarifies that what occurs by chance and is incidental excludes *both* what happens "always" (ἀεὶ, *Met.* E.2, 1027a.18) and what occurs not always but merely "for the most part" (ὡς ἐπὶ τὸ πολύ, *Met.* E.2, 1027a.18).

105. Burnyeat (1981, 110).

106. Gerson (2009, 67–69) and van Fraassen (1980, 25–28) likewise explain Aristotle's position by appealing to the fact that what is explained in science is a non-incidental regularity. In fact, I will argue in chapter five that Aristotle *does* take even certain exception-permitting regularities to be necessities; but none of these commentators convincingly explain *how* exception-permitting regularities may count as necessities. Absent such an explanation, however, pointing to the fact that Aristotlelian understanding is of non-incidental regularities does not explain why Aristotle holds that the objects of *epistēmē* are necessities. Thus, my criticism is not that these commentators are wrong to point to the non-incidental character of *epistēmē*, but that this does not on its own explain why Aristotle should take *epistēmē* to be of necessities.

107. *Illiad* ii 611, v 60 and xv 282. Cf. Lesher (2001, 50), Chantraine (1968, 360), Gould (1955, 6–9) and Snell (1924, 82–83).

felt strongly enough that scholiasts and lexicographers on the Illiad consistently gloss the term simply with δύνασθαι (to be able to).[108] The physical connotation is often attenuated or absent outside epic, as when Archilochus adverts to his ability as a poet by describing himself as "knowing the lovely gift of the Muses,"[109] but even here, as in almost all archaic usages, a connection with ability and some type of action or activity is implied.[110]

From the 4th century onwards, the usage of *epistasthai* broadens, and occurrences with a propositional complement[111] rather than a complementary infinitive become more common. In both Attic tragedy and oratory, it is used to ascribe knowledge of simple matters of fact.[112] The connotation of expertise and skill does not disappear, however,[113]

108. Gould (1955, 9). See further Snell (1924). Gould (1955) recommends translating it in these contexts as "know how," but this fails to capture the fact that it generally referred to mastery of a particular skill-set, rather than the ability to achieve some specific end. See Burnyeat (2011) for further doubts regarding attempts to map Ryle's knowing how/knowing that distinction onto philosophical Greek usage.

109. Μουσέων ἐρατὸν δῶρον ἐπιστάμενος, fr. 1.2.

110. An interesting exception is Herodotus, who, alongside usages representative of this type, sometimes uses *epistasthai* simply to describe someone's feeling of certainty regarding some future state of affairs, even one that does not in fact transpire. Thus Doreius is said to "know" that he would become king, even though it turned out that his older brother Cleomenes took the crown (*Histories* V, 42.1). See further Gould (1955, 10).

111. Typically a ὅτι-clause, or a participle with an accusative subject.

112. Thus Isocrates, in *De Bigis* 24.6–10, tells his audience: "I desire very much to recount to you my father's private pursuits, going back a little to make mention of his ancestors, that you may know [*epistēsth'*] that from early times our standing and services have been the greatest and most honorable among the citizens of Athens," while the servant woman in Euripides' *Alcestis* reports that "the whole city knows" (πᾶσ' ἐπίσταται πόλις, 156) that Alcestis intends to die in place of Admetus. In neither of these cases is any special connection with an ability implied.

113. Lesher (2001, 51–52).

and usages denoting a practical ability are found alongside such usages in Attic texts.[114]

Lesher (2001) argues that the connection with practical mastery may help to explain certain features of Aristotle's usage of *epistēmē*. Someone in possession of *epistēmē haplōs* needs to be thoroughly acquainted with the whole discipline which encompasses the fact of which she has *epistēmē*.[115] She must not only be aware of every truth that constitutes the discipline, but must master the connections between them, a skill manifested in her aptitude at constructing demonstrations.[116] Her mind must assimilate (lit. "grow together with"[117]) that body of knowledge in the manner of someone who has mastered a skill or craft.

The idea of *epistēmē* as a body of practical expertise may also help to explain why Aristotle thinks of *epistēmē* as something to be employed or made use of. Aristotle distinguishes on multiple occasions between "having" and "using" *epistēmē*.[118] At least in the former sense, Aristotle thinks of it as a type of ability that may be employed over some

114. For instance, Thucydides reports that the Peloponnesian commanders roused their troops by telling them "this knowledge [*epistēmē*] of theirs, which you so much fear, joined with courage will not be without a memory also to put what they know in execution; yet without courage no art in the world is of any force in the time of danger." (τῶνδε δὲ ἡ ἐπιστήμη, ἣν μάλιστα φοβεῖσθε, ἀνδρείαν μὲν ἔχουσα καὶ μνήμην ἕξει ἐν τῷ δεινῷ ἐπιτελεῖν ἃ ἔμαθεν, ἄνευ δὲ εὐψυχίας οὐδεμία τέχνη πρὸς τοὺς κινδύνους ἰσχύει. *De Bello* 2.87.4). The coordination of *epistēmē* with "experience" and "skill" makes clear that the knowledge in question is not simply knowledge of contingent facts that may lend them an advantage, such as where the enemy is encamped or how they plan to attack, but rather a sort of knowledge developed over time by accruing experience, perhaps something more like expertise in warfare. Even Plato takes it for granted that the *epistēmē* which is contrasted with opinion is a "capacity" (δύναμις, *Rep.* V, 477b.5), something "in virtue of which we are able to do what we are able to do" (*Rep.* V, 477c.1–2). For further Attic usages of *epistēmē* denoting skills and abilities, see Lesher (2001, 51–52n.21).

115. Lesher (2001, 50); cf. Ferejohn (1991, 49–52).

116. "we must also become so familiar with the subject that the entire nexus of truths and proofs becomes internalized within our minds [...], or 'second nature.'" (Lesher 2001, 50).

117. συμφυῆναι, *Nic. Eth.* 1147a.22.

118. See the references on p. 55.

range of circumstances or cases. Just as warcraft gives one a repeatable ability to engage in war, or skill in shipbuilding gives one a repeatable ability to construct ships, so too knowledge, in the sense of "having" knowledge, gives one a repeatable ability to apply what one knows to particulars encountered in thought and perception. Usages of *epistēmē* in the other sense are then thought of as *exercises* or *applications* of this general ability.

This distinction between *epistēmē* and its use or employment, which probably stems from its use to describe practical mastery of a skill or craft, will be important for understanding the structure of Aristotle's position as regards the necessity of the object of *epistēmē*. For, as we will see, Aristotle only makes his necessity claim about *epistēmē* in the sense of the thing that we "have," corresponding to the content of a repeatable skill, not about its "use," corresponding to the skill's implementation or exercise. Even if the content of the *epistēmē* is restricted to necessities, then, Aristotle leaves room in the implementation of *epistēmē* for contingent matters of fact. Nevertheless, this distinction does not help us to see why Aristotle takes that content itself to be composed of necessities, even if it helps us to see how such a position might avoid absurdity by leaving room for contingencies in the application of *epistēmē*.

The insufficiency of these linguistic clarifications to fully explain why Aristotle holds that we only have *epistēmē* of necessities demonstrates, I think, that Aristotle's thesis is more than just a terminological claim. We cannot explain why Aristotle holds the position he does simply by arguing that Aristotle means "knowledge," "understanding" or "scientific knowledge." Both those who, following Ross and the tradition, translate *epistēmē* as "(scientific) knowledge" and those who, following Kosman and Burnyeat, translate it as "understanding" must still rely on the postulation that Aristotle is talking about a very specific type of knowledge or understanding, but no party satisfactorily explains what type of knowledge or understanding Aristotle means such that his claim is an analytic claim about that type of knowledge or understanding. Simply saying that this knowledge or

understanding is "scientific" does not explain why it needs to be of necessities, given the range of sciences Aristotle recognizes. Aristotle owes us an argument for his claim, even if the immediate context of the passages where he makes this claim in the *Posterior Analytics* fail to provide one. Rather than speculating on the meaning of Aristotle's terms, we are better served by examining more closely what reasons for his position Aristotle actually gives.

## 1.3 Some first steps toward an answer

The general shape of Aristotle's argument that what we know is a necessity may be ascertained from *Nicomachean Ethics*, book VI. That book begins with Aristotle's division of the soul into a non-rational and a rational part.[119] The former bears the virtues of character that books II-V focus on; the latter bears the "intellectual" virtues that Aristotle discusses in book VI. Within the rational part of the soul, Aristotle makes a further division:

> **T2** let it be supposed that there are two parts that have reason, one by which we contemplate the sorts of things whose principles cannot be otherwise, one concerned with those things which can be otherwise.[120]

Aristotle dubs the former of these the "deliberative" or "calculative" part,[121] the other the "scientific" part.[122] "Knowledge," along with wisdom and insight, is a virtue of the scientific part of the soul. As such, knowledge is a *hexis* or "state" like character virtue: A gradually acquired, relatively permanent condition associated with a range of characteristic

119. *Nic. Eth.* VI.1, 1139a.4.

120. ὑποκείσθω δύο τὰ λόγον ἔχοντα, ἓν μὲν ᾧ θεωροῦμεν τὰ τοιαῦτα τῶν ὄντων ὅσων αἱ ἀρχαὶ μὴ ἐνδέχονται ἄλλως ἔχειν, ἓν δὲ τῶν ἃ ἐνδέχονται, *Nic. Eth.* VI.1, 1139a.6–8. Following $K^b$ against the OCT.

121. λογιστικόν, *Nic. Eth.* VI.1, 1139a.12.

122. ἐπιστημονικὸν, *Nic. Eth.* VI.1, 1139a.12.

qualities and capacities.[123] It is "knowledge" only in the sense that we might ascribe to someone when we would call them "knowledgeable," not in the sense that we might say someone knows something who has just learned it or understands it only poorly.[124] Knowledge in this sense stands apart from the practical virtues in that it is directed toward the contemplation of things whose "principles" cannot be otherwise.[125] Aristotle adds shortly thereafter that not only the principles, but the objects of this virtue themselves ("*what* we have knowledge of")[126] cannot be otherwise.

Aristotle's claim that knowledge is of what cannot be otherwise is thus backed by a taxonomy of the parts of the soul. It is of necessities because it is the virtue of the part of the soul that contemplates things whose principles cannot be otherwise, as opposed to the deliberative part of the soul that engages veridically with things that can be otherwise. Yet this only bring us so far in understanding Aristotle's position, because it is difficult to see what motivates this division. Aristotle explains clearly enough why he takes the deliberative part of the soul to be associated with things that *can* be otherwise: Its function is to act on the world as the result of a process of deliberation, and "no one deliberates about what cannot be otherwise."[127] We deliberate about things that we believe we can change and, *a fortiori*, about things that can change.[128] Anyone who knows Pythagoras's theorem cannot coherently intend to render the diagonal of a triangle commensurate with

123. See my discussion in section 2.1.2.

124. *Nic. Eth.* VII.3, 1147a.21–22. Aristotle here uses the verb εἰδέναι rather than ἐπίστασθαι, but Burnyeat (2011) argues that, on Aristotle's usage, if someone has εἰδῆσις of something, they have either ἐπιστήμη or γνῶσις, and the latter is entailed by (but does not entail) ἐπιστήμη. It follows that if someone fails to have εἰδῆσις if they have just learned something, they also fail to have ἐπιστήμη.

125. *Nic. Eth.* VI.1, 1139a.7–8.

126. ὅ ἐπιστάμεθα, *Nic. Eth.* VI.3, 1139b.20.

127. οὐδεὶς δὲ βουλεύεται περὶ τῶν μὴ ἐνδεχομένων ἄλλως ἔχειν, *Nic. Eth.* VI.1, 1139a.12–14.

128. *Nic. Eth.* III.3, 112a.20–31.

its side, and so nor can they, according to Aristotle, coherently deliberate about how to accomplish this.[129] Yet even if all those things we engage with in a deliberative mode must have the possibility of being otherwise, it hardly follows that all those things which we engage with in a *non*-deliberative mode *cannot* be otherwise.

Aristotle elaborates only briefly on the rationale for his division of parts of the rational soul by their objects in *Nicomachean Ethics* VI.1:

> **T3** Where beings differ in kind, so too the parts of the soul that relate to each nature differ in kind, since they apprehend according to a kind of affinity and likeness.[130]

This rationale recalls Aristotle's theory of perception, according to which the perceptual organ perceives by virtue of being affected by something it is potentially like.[131] The organ of sight senses the presence of something colored by encountering something with a color and itself becoming, literally or metaphorically,[132] colored in that way. Aristotle extends the metaphor to knowledge,[133] despite holding that there is no organ of intellect to take on the qualities of intelligible things.[134] Yet it is far less clear what the relevant "likeness" consists in here. In what sense is this part of the soul itself "incapable of being otherwise"?

One suggestion that is perhaps at first tempting is that Aristotle means that knowledge itself, at least in the sense that manifests an intellectual virtue, is "like" a necessity in that it is deeply held or ingrained. Aristotle does often allude to the exceptional stability of

129. *Nic. Eth.* III, 112a.22–23.

130. πρὸς γὰρ τὰ τῷ γένει ἕτερα καὶ τῶν τῆς ψυχῆς μορίων ἕτερον τῷ γένει τὸ πρὸς ἑκάτερον πεφυκός, εἴπερ καθ' ὁμοιότητά τινα καὶ οἰκειότητα ἡ γνῶσις ὑπάρχει αὐτοῖς, *Nic. Eth.* VI.1, 1139a.9–11.

131. See *De An.* II.5, 418a.3–6, II.12, 424a.17–21. The probably spurious *Magna Moralia* makes the connection explicit: See I.34, 1196b.15–34.

132. On this controversy, see Sorabji (1974), Burnyeat (2002) and Caston (2004).

133. *De An.* II.8, 431b.20–23.

134. *De An.* III.4, 429a.24–7.

knowledge,[135] characterizing it as one of the most "permanent" states of the soul.[136] Yet the other state Aristotle mentions in these contexts is practical virtue. Like knowledge, it too is gradually acquired and does not tend to be forgotten.[137] But Aristotle takes practical knowledge to pertain to the other part of the rational soul, that which considers things which are capable of being otherwise,[138] and beliefs, too, may be deeply held.[139] So the fact that knowledge in the relevant sense is deeply held or inculcated cannot be the sense in which the scientific part of the soul is "incapable of being otherwise," if that is to distinguish it from the deliberative part.

For Aristotle, the fact that it is deeply held is not the only sense in which a cognitive state may be stable, however. Even a deeply ingrained belief may, along a different axis, be highly unstable for Aristotle. Beliefs can be unstable in the sense that their correctness may alter, for Aristotle, even while the believer continues to hold the same belief.

Take the belief that Socrates is sitting. Suppose that Socrates is now sitting. If you believe that Socrates is sitting, you currently have a true belief. But Socrates does not *have* to be sitting. He could get up at any moment. Suppose he does: At this point, Aristotle holds, "you will believe falsely if you hold the same belief about him."[140] You come to have a false belief not because you changed your mind, but rather because the thing you were thinking about has gone from being in the condition you believe it to be to not being in this condition.[141] And hence, while you are thinking the very same content ("Socrates is

135. *Cat.* 8, 8b.27–32, *Post. An.* I.2, 72b.3–4.

136. *Cat.* 8, 8b.33–35; cf. *Nic. Eth.* I.10, 1100b.12–17, II.4, 1105a.33.

137. *Nic. Eth.* II.1, 1103a.14–19, I.13, 1103a.3–4, VI.5, 1140b.28–30.

138. *Nic. Eth.* VI.5, 1140b.25–30.

139. See also *Post. An.* I.33, 89a.11–23, where Aristotle makes the point that one might have true beliefs about all of the propositions in a science. See also *Top.* I.10, 104a.8–15, where Aristotle describes beliefs that are universally accepted.

140. *Cat.* 5, 4a.27–28.

141. *Cat.* 5, 4a.34–4b.2, 4b.6–13.

sitting"), your belief may go from being true to being false.[142] In this sense beliefs may be "unstable" despite being deeply held.[143]

Knowledge differs from belief in this respect. Unlike belief, knowledge is "always true."[144] When Aristotle says this, we may read him as simply acknowledging the factive property of knowledge, acknowledging, that is, the principle that if $p$ knows $S$, then $p$ is true. While Aristotle surely does take knowledge to be factive,[145] he can also be understood to mean something more literal. What one knows differs from what one can believe in that its truth-value does not alter. What one knows never *goes* from being true to being false. Aristotle expresses the idea in a tangled formula:

> **T4** knowledge is not sometimes knowledge and sometimes ignorance – rather, it is belief that is like this.[146]

Knowledge cannot be "sometimes knowledge and sometimes ignorance." Aristotle's formulation is paradoxical, but the underlying idea is clear. It expresses an intuition that we, I think, still share. The mental states that presently constitute our knowledge do not fluctuate erratically between constituting knowledge and failing to constitute knowledge. To be sure, we may forget something and in this way cease to know. And we may cease to know for more dramatic reasons, such as a blow to the head. But it would be very strange if someone were to suddenly cease to know what they knew, without any such cognitive harm or failure. If this were a regular occurrence, knowledge would not have the function and utility that we rely on it to have. For at least part of the reason why

142. See further my discussion of T10 on p. 49.

143. ἀβέβαιον, *Post. An.* I.33, 89a.5–6. Cf. *Met.* Θ.10, 1051b.13–15, Z.15, 1039b.32–a.1, *Post. An.* II.19, 1005.5–7.

144. ἀληθῆ ἀεὶ ἐπιστήμη, *Post. An.* II.19, 100b.8.

145. *Post. An.* I.2, 71b.25–6.

146. οὐδ' ἐπιστήμην ὁτὲ μὲν ἐπιστήμην ὁτὲ δ' ἄγνοιαν εἶναι, ἀλλὰ δόξα τὸ τοιοῦτόν ἐστιν, *Met.* Z.15, 1039b.32–34.

we care about having knowledge, and not just beliefs (even true ones), is that we take knowledge to be something we can *rely* on in a way that we may not with belief. That is an essential component of the basis for distinguishing certain mental states with the accolade "knowledge" from mere beliefs.[147]

Contemporary philosophers who emphasize the importance of reliability in connection with knowledge tend to construe this condition rather differently. Reliabilists in contemporary epistemology tend to focus on the need for our knowledge states to be reliably *formed*. What is needed for something to count as knowledge rather than mere belief, on this view, is that the process which gives rise to it reliably gives rise to truths.[148] A mental state that is the result of a process that generally leads to false beliefs but this time delivers a true one cannot count as knowledge, because we then lack the appropriate justification for our true belief, even if in this case our belief is true.

This is one respect in which knowledge must be reliable. But there is another aspect of knowledge's reliability that contemporary epistemologists occupy themselves with less, and which is more squarely Aristotle's concern. In addition to having been formed in a reliable manner, knowledge must also be something that we can *continue* to rely on in our judgements and practices once we have formed it. For we rely on our knowledge to navigate through a changing world. If our knowledge were to fluctuate from true to false as easily and often as Socrates gets up and sits down, it would lack one of the key features that makes it valuable for us.

That is, in addition to the *backward-looking* sense of reliability that contemporary epistemologists focus on, there is also an intuitive *forward-looking* sense in which knowledge

147. Cf. Bolton (2012) for this idea in Aristotle. See Kvanvig (2003) for a discussion of these issues in a contemporary setting.

148. The classic statement of this view is Goldman (1986). Goldman and Beddor (2016) write, regarding Goldman's own paper: "the main proposal of "What Is Justified Belief?" was that a belief's justifiedness is fixed by the reliability or unreliability of the process or processes that cause it." See also Dretske (1981).

must be reliable. When Aristotle claims that knowledge is "always true" and cannot be "sometimes ignorance," he is talking about this forward-looking reliability. He is talking about the need for our knowledge states, once formed, to be reliable indicator of truth into the future.

Less gets said about this reliability of knowledge *once formed*, the reliability of the ongoing mental state. Part of the reason why the forward-looking stability of knowledge is less discussed in contemporary philosophy is that contemporary philosophers tend to think of the contents of our truth-apt mental states as time-indexed. That is, they tend to think of the contents of what we know, think or believe as a state of affairs at a particular time, which in principle is not subject to change. Frege gives a vivid expression of this idea in *Thought*:

> The thought that we express by the Pythagorean Theorem is surely timeless, eternal, unvarying. But are there not thoughts which are true today, but false in six months time? The thought, for instance, that the tree there is covered in green leaves, will surely be false in six months' time. No, for it is not the same thought at all. The words 'This tree is covered with green leaves' are not sufficient by themselves to constitute the expression of thought, for the time of utterance is involved as well. Without the time-specificaiton thus given we have not a complete thought, i.e. we have no thought at all. Only a sentence with the time-specification filled out, a sentence complete in every respect, expresses a thought. But this thought, if it is true, is true not only today or tomorrow but timelessly.[149]

For Frege, "the tree there is covered with green leaves" is not, strictly speaking, a possible content of a thought. Only when supplemented by a "time-specification"[150] does

149. Frege (1997, 76).

150. Frege (1997, 76).

this sentence serve to specify a possible thought. Frege's idea is that saying that someone thinks "the tree is covered with green leaves" is always elliptical for saying that someone thinks that the tree is covered in green leaves at time $t$ (where the time specification is part of the content of what is thought, not a specification of *when* it is thought). Now, whereas the tree may lose its leaves, the fact that the tree *at time* $t$ is covered in green leaves does not change truth-value with it. It is true or false once and for all.[151] Thus when I think, first, that the tree is covered in green leaves at a time when it in fact is, I am on this view in fact thinking the thought that the tree is covered in green leaves at time $t$; when I later think that it is covered in green leaves, the content of my thought is that it is covered in green leaves at time $t'$. Each of these thoughts is "timelessly"[152] true despite the change in the tree. The components of the thought are not the tree itself, which may change, but rather only the senses expressed by the words "tree," "green," etc. Thoughts exist neither in the mind of the thinker nor in the changing world of trees and leaves, but in a "third realm" of timeless truth.[153]

This gives Frege a way to hold that thoughts themselves do not change in truth-value, even while the things they are *about* do change. Since thoughts about changing things are only ever thoughts that such-and-such holds at time $t$,[154] it would be incoherent, Frege thinks, to take them to be capable of changing truth-value. The forward-looking reliability of thoughts is therefore guaranteed, because we never really have an intensional mental state whose content is the type of thing that it even makes sense to talk about changing.

While contemporary epistemologists have dropped talk of a third realm, the assumption that the contents of intensional states like knowledge, thought and belief are of a

151. Frege (1997, 76).

152. Frege (1997, 76).

153. Frege (1997, 69).

154. In the passage above, Frege is not as clear about whether he holds this also of thoughts like the thought of the Pythagorean Theorem.

*proposition*, and that propositions are as such exempt from changes on account of changes in what they refer to, remains commonplace, although it is less often articulated as explicitly as it is in Frege. Aristotle, however, recognizes no such class of essentially timeless truth-bearers.[155] In giving his account of the truth and content of thoughts and beliefs, he makes no use of a third entity separate from the tree itself and the mental act or state which represents it. Instead, for him, the bearers of truth are our mental states and utterances themselves.[156] *My* thought – the token feature of my own mental state in virtue of which I represent the tree as covered in green leaves – is what is primarily true or false.[157] It is true when the tree has green leaves, and false when the tree is bare.

This means that the contents of our mental states reach out into a changing world for Aristotle. Their truth and falsity is not borne by a changeless surrogate or intermediary but by complexes of real, changing objects and their properties. The thing that I think when I think that Socrates is sitting is the Greek philosopher, beard and all, in his residing position. Likewise, the thing that I would know, were I able to know that Achilles is angry, would be a complex containing the Greek warrior himself, full of wrath. And this at least threatens to entail that my knowledge will be as changeable as Achilles.[158] Aristotle's lack of timeless truth-bearers for the contents of mental states thus open a problem about the possibility of stable knowledge, one that does not arise for most contemporary theories given their views of the contents of cognitive states as time-indexed. And Aristotle addresses this problem, I will argue, by placing a restriction on the possible contents of

155. This is argued at length in Hintikka (1973). Aristotle does discuss demonstrations involving time-indexed propositions at *Post. An.* II.12, 95a.10–21, but his point is that such demonstrations only come about if there is a corresponding demonstration containing premises that are *not* time-indexed.

156. See Crivelli (2004, 45–76).

157. See pp. 47–51 of section 2.1.1 and section 4.2.

158. Cf. Hintikka (1973, 74–75). We need not accept Hintikka's theory about the origin of knowledge terms in perceptual language in order to accept this point.

knowledge. If mental states, for Aristotle, reach out into a changing world, but knowledge is required to be "always true," then it must touch only those aspects of reality that themselves remain fixed: Only, in Aristotle's parlance, what "cannot be otherwise" or is a "necessity."

## 1.4 Chapter breakdown

Seeing that this is how Aristotle argues will be the task of the next chapter, in which I reconstruct Aristotle's only explicit argument for the necessity of what we know, given tersely at *Nicomachean Ethics* VI.3, 1139b.21–4. By reading these passages in light of Aristotle's remarks about knowledge in the *Categories*, I show that these arguments serve to reconcile two facets of knowledge that stand in tension. According to *Categories* 7, knowledge is a dependent mental state, requiring the perdurance of an object for its own continued existence; according to *Categories* 8, it is a stable mental state, one that persists so long as the knower comes to no harm. Aristotle reconciles these two features of knowledge by positing that the contents of our knowledge states do not vary in their truth-values over time.

This chapter aims to answer the first of my guiding questions, namely, *why* does Aristotle hold the view that knowledge is the type of mental state that only permits necessities as its objects. The subsequent chapters turn to my other question, namely, *how* can Aristotle hold that we only know necessities. I address this question in the third chapter by asking what Aristotle takes the object of knowledge to be: What are the "necessary" things that, according to Aristotle, we know? I approach this question first by examining how Aristotle presents his view as an alternative to postulating Forms. I show that Aristotle takes the Academic postulation of Forms to be motivated by similar considerations to his own, but to go awry in postulating a special class of unchanging individuals for knowledge as an attempt to address his dilemma. Aristotle's own theory of *per se* predication in the *Posterior*

*Analytics*, I argue, is an attempt to explain how knowledge can be of necessities without positing for it a special domain of imperishable, eternal or transcendent individuals.

The fourth chapter then moves to consider the metaphysical basis of these necessities. I show how Aristotle aims to ground knowable necessities in the simplicity of the constituents that form the knowable world, and explore how this relates to Aristotle's theory of demonstrative principles in the *Posterior Analytics*. In chapter five, I consider more concretely how Aristotle's claim is compatible with the practice of natural science, given that natural scientists study phenomena that as such produce exceptions. I argue that Aristotle aims to bring exception-permitting generalizations in natural science under the rubric of his theory of scientific knowledge by thinking of these as "interrupted" necessities. Properly understood, I argue, Aristotle's claim that we only know necessities does not restrict knowledge to a particular domain, but rather provides for the multiplicity of the types of things that we do, in Aristotle's view, know.

# CHAPTER 2

# ARISTOTLE'S DURABILITY ARGUMENTS

In this chapter, I consider the arguments Aristotle gives for the necessity of the object of knowledge. I call these "durability" arguments. They have in common that they attempt to establish the character of the object of knowledge on the basis of considerations pertaining to the stable and reliable character of knowledge as a mental state, especially its tendency to persist and resist erasure or change. A number of basic premises of the durability arguments show up in Aristotle's considerations regarding which of the ten categories knowledge belongs to. I therefore begin by considering the *Categories*.

## 2.1 Knowledge in the *Categories*

### *2.1.1 Knowledge as a relative:* Categories *7*

Knowledge is assigned to the category of *relative* in *Categories* 7 on the grounds that this category encompasses

> **T5** all such things as are said to be just what they are, *of* other things, or in some other way *in relation to* something else. For example, the larger is called just what it is *than* something else (it is said to be larger than something); and what is double is called just what it is *of* something else (it is called double of something)[1]

Other examples of relatives given in *Categories* 7 include master and slave,[2] perception

1. πρός τι δὲ τὰ τοιαῦτα λέγεται, ὅσα αὐτὰ ἅπερ ἐστὶν ἑτέρων εἶναι λέγεται ἢ ὁπωσοῦν ἄλλως πρὸς ἕτερον· οἷον τὸ μεῖζον τοῦθ' ὅπερ ἐστὶν ἑτέρου λέγεται, – τινὸς γὰρ μεῖζον λέγεται, – καὶ τὸ διπλάσιον ἑτέρου λέγεται τοῦθ' ὅπερ ἐστίν, – τινὸς γὰρ διπλάσιον λέγεται, *Cat.* 7, 6a.36–6b.2.

2. *Cat.* 7, 6b.29–30.

and the object of perception,[3] similar[4] and unequal.[5] Aristotle demarcates this class of beings in terms of their having what the literature calls a "correlative," a second being that the relative is qualified with using a relational expression like "*of*" or "*than*."[6] Knowledge passes this test for being a relative: Just as a larger thing is said to be larger *than* something, and a double the double *of* something, so too "knowledge is knowledge of something."[7]

Aristotle does not count as a relative just any being that is said to stand in a relation to something else, however. That definition would make almost everything a relative (a particular cow is the cow *of* the farmer, the prime mover is the prime mover *of* the heavens, etc.), and Aristotle wants to avoid this result.[8] Instead, it seems clear that Aristotle takes relative terms to depend on their correlatives in a *special way*: If R is a relative term, then calling something an R, in the absence of further supplementation or appropriate context, is a semantically incomplete utterance.[9] It raises the question what it is an R *of*, *than*, or "in some other way in relation to." If something is designated as the larger, we will want to know what it is larger *than*; if someone is referred to as a father, we will not know who is being referred to until we know whose father he is.

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3. *Cat.* 7, 6b.35–36.

4. *Cat.* 7, 6b.20–22.

5. *Cat.* 7, 6b.20–22.

6. Both these prepositions translate a genitive in the Greek of T5. Aristotle gives no indication that the correlative must always occur in the genitive: His use of ὁπωσοῦν ἄλλως at 6b.7–8 in fact suggests that he means to allow other grammatical cases or prepositional constructions. Occasionally he also uses examples with the dative: A similar thing is a relative because it is said to be similar *to* something else (τινί, 6b.9). Philoponus (*in Cat.*, 106,8–11) explicitly allows the relative to be in the dative.

7. ἡ ἐπιστήμη τινὸς ἐπιστήμη, *Cat.* 7, 6b.5.

8. Aristotle goes to pains to avoid the conclusion that substances are relative terms: See *Cat.* 7, 8a.13–8b.24.

9. For an interpretation of Aristotle on relatives that focuses on the notion of semantic incompleteness, see Morales (1994). Cf. also Ackrill (1975, 99) and Hood (2004, 89–90).

Aristotle highlights this in T5 with the phrase "just what."[10] Relatives are demarcated as those beings for which a predication saying "just what" they are mentions some relation to another being.[11] To have a magnitude greater than some smaller thing is "just what it is" to be larger; to be a male parent of a child is "just what it is" to be a father. Of course, it is not the character of such a *statement* that makes something a relative, but rather what is responsible for the truth of such a statement, a point Aristotle clarifies when he refines his definition of relatives at 8a.31–32: "relatives are those things for which to be is the same as to be related to something in a certain way."[12] That is, for a relative to exist is at least in part[13] for it to stand in the appropriate relation to its correlative, where this relation is understood as a matter of ontology and not merely linguistic usage. In particular, for there to be knowledge is, at least in part, for something to stand in an appropriate relation to some object of knowledge. Put another way, it is part of the essence of knowledge (part of what it is for something to be an instance of knowledge) that it bears a relation to its

10. ἅπερ, *Cat.* 7, 6a.36.

11. Cf. *Post. An.* I.4, 73b.8, where substances are defined as those terms for which saying "just what it is" (ὅπερ ἐστὶν) does, by contrast, *not* involve recourse to any other "underlying subject." This may explain some of Aristotle's eagerness to avoid the conclusion that substances are relatives at 8a.13–8b.24.

12. τὰ πρός τι οἷς τὸ εἶναι ταὐτόν ἐστι τῷ πρός τί πως ἔχειν, 8a.31–32. The relationship of this definition to the one given in T5 has been discussed since antiquity. I remain neutral here on whether, as most ancient and many modern commentators contend, the difference between linguistic usage and metaphysics is primarily what is at issue when Aristotle provides his revised definition (for this view see Hood 2004, 39; Morales 1994, 260; and Ackrill 1975, 101), or whether, as Sedley (2002) argues, Aristotle is making a different distinction and merely clarifying *en passant* that questions about relatives are questions of a metaphysical nature (on this further see the next note). On either reading, Aristotle's considered view is that being a relative is a matter of metaphysics and not only language.

13. Sedley (2002) draws a distinction between what he calls "hard" and "soft" relatives. "Hard" relatives are those relatives R for which being R consists *wholly* in being related to some other entity. "Soft" relatives are those for which being related is only part of what it is to be R. I agree with Sedley that Aristotle recognizes both types of relatives, and exploit a similar distinction below. I will remain neutral, however, on Sedley's claim that it is this distinction which is principally at issue at *Cat.* 8a.29–37. For reasons to doubt this, see Duncombe (2015).

correlative object, to what it is knowledge *of*.[14]

This is the respect in which knowledge is like the double, the half and the equal: These, too, exist both *in* something else and are *of* something else.[15] But Aristotle also holds that knowledge differs from these examples of relatives. A key distinction is made by means of a notion of being "simultaneous in nature," which he introduces as follows:[16]

> **T6** Relatives seem to be simultaneous in nature. And in most cases, this is true: (a) At the same time there is a double there is its half, and (b) when there is a half, there is its double, and (a) when there is a slave, there is its master. Likewise with the others. And they also co-annihilate each other: (c) If there is not a double, there is not its half, and (d) if there is not a half there is not its double, and so on in all the other cases like this.[17]

Aristotle gives the name "being simultaneous in nature" (I will call it "simultaneity" for short) to a type of bidirectional dependence that holds between members of relative-correlative pairs. It may be tempting to take Aristotle to mean that relatives simultaneous in nature are those for which (a) the existence of the relative implies the existence of its correlative and (b) the existence of the correlative, in turn, implies the existence of the relative. The second sentence would then be a statement of these conditions in contrapositive form: (c) The non-existence of the correlative implies the non-existence of the relative, and (d) the non-existence of the relative implies the non-existence of its correlative. But this fits ill with the example Aristotle gives: A slave does not cease to *exist* when it loses its master, but rather ceases to be *that master's slave*; likewise, a master of a certain slave

14. For a different view, see Mignucci (1986).

15. Cf. Morales (1994, 257–58, 261).

16. See also *Cat.* 13, 14b.28–32.

17. δοκεῖ δὲ τὰ πρός τι ἅμα τῇ φύσει εἶναι. καὶ ἐπὶ μὲν τῶν πλείστων ἀληθές ἐστιν· ἅμα γὰρ διπλάσιόν τέ ἐστι καὶ ἥμισυ, καὶ ἡμίσεος ὄντος διπλάσιόν ἐστιν, καὶ δούλου ὄντος δεσπότης ἐστίν· ὁμοίως δὲ τούτοις καὶ τὰ ἄλλα. καὶ συναναιρεῖ δὲ ταῦτα ἄλληλα· μὴ γὰρ ὄντος διπλασίου οὐκ ἔστιν ἥμισυ, καὶ ἡμίσεος μὴ ὄντος οὐκ ἔστι διπλάσιον· ὡσαύτως δὲ καὶ ἐπὶ τῶν ἄλλων ὅσα τοιαῦτα, *Cat.* 7, 7b.15–22. I have articulated the text into (a), (b), etc. for the purposes of exposition.

ceases to be that slave's master when the slave is liberated, but does not cease to *exist*. This suggests that the correct condition is rather the following: If R and C are a simultaneous relative-correlative pair of beings, then (a) when something is an R, there exists something else which is a C of it and (b) when something is C, then there is something which is an R of it. For instance, when something is a slave (or a half), there is something else which is its master (its double), and when something is a master (double), there is something else that is its slave (half). The final sentence states the corollary that results from taking the contrapositive of these conditions: In order for a relative-correlative pair to be simultaneous in naure, it must be the case that, for any thing, (c) when there is nothing that is C of that thing, that thing is not R (when there is no longer a master of some slave, that slave ceases to be a slave); and likewise, (d) when the R of something cases to be R, that thing ceases to be the C of R (when all the slaves of some master cease to be slaves, the master ceases to be master).[18]

We may think of condition (a) (or the logically equivalent (c)) as articulating a certain relation of *dependence* of the relative R on its correlative C. Condition (b) (and the logically equivalent (d)) then state the same condition with the roles of R and C reversed. Aristotle's simultaneity condition thus boils down to the condition that R and C depend on one another, in the specific sense that every R requires there to be something that is its C, and conversely every C requires there to be something that is its R.

Aristotle holds that *not* all relative-correlative pairs have this complex property of

18. Formally, we have, for all $x$ and at any time $t$:

(a) $x$ is an R $\supset$ $(\exists y)(y$ is a C of $x)$
(b) $x$ is a C $\supset$ $(\exists y)(y$ is an R of $x)$
(c) $\neg(\exists y)(y$ is a C of $x) \supset \neg\ x$ is an R [contrapositive of (a)]
(d) $\neg(\exists y)(y$ is an R of $x) \supset \neg\ x$ is a C [contrapositive of (b)]

where these are taken each to hold at all times. I avoid attempting to analyze "$x$ is an R," "$y$ is a C of $x$," etc. so as to sidestep the famously thorny issue of whether Aristotle has a concept of a multi-place predicate: For a modern treatment of the issue, see Hood (2004).

simultaneity.[19] While all relatives depend on their correlatives, in some cases the correlative does not depend reciprocally on its relative. This is consistent with what we have seen so far. For although every individual qualified by a term R requires the existence of its correlative in order to be a thing of type R, Aristotle has not said that the mere existence of a correlative is in general *sufficient* for there to be something of type R. In certain cases – or even, Aristotle says, "in most cases"[20] – this is, however, sufficient: For something to be a larger thing, for instance, it is sufficient that the thing smaller than it exist.[21] And so, there being a smaller thing, *ipso facto* guarantees that there is a larger thing. Likewise, there being a larger thing *ipso facto* guarantees a smaller. But in other cases, the inherence of a relative attribute in its subject may depend on that subject having further, non-relational properties besides the mere existence of its correlative.[22] In that case, while the relative will still depend on its correlative, the mere existence of the correlative will not on its own guarantee that there is something satisfying the description of the relative term.

This is precisely what Aristotle takes to be the case with knowledge and its correlative object, which is his chief example of simultaneity *failing*:

19. *Cat.* 7, 7b.22.

20. ἐπὶ μὲν τῶν πλείστων, *Cat.* 7, 7b.15–16.

21. *Met.* I.6, 1057a.1–2.

22. Cf. Morales (1994, 257–59).

**T7** It is not held to be true in all cases of relatives that they are simultaneous in nature: The object of knowledge might be held to be *prior* to knowledge. [...] When the object of knowledge is annihilated, knowledge is annihilated with it, but when knowledge is annihilated, the object of knowledge is not annihilated with it. For, if there is no object of knowledge, there will be no knowledge – there will be nothing for knowledge to be *of* – but if there is no knowledge, there is nothing to prevent there still being an object of knowledge.[23]

Knowledge and its object satisfy condition (a) of simultaneity. If someone's soul is in a condition of knowledge, then something else, the correlative of that knowledge, is an object of knowledge. Knowledge is in this way *object-directed*: To have knowledge is essentially to know *something*.[24] Knowledge and its object also satisfy (c): If, at any time, the correlative is not an object of knowledge, then, at that time the state of the soul will not be a state of knowing it. Hence, if the correlative object ceases to be an object of knowledge, the person's condition will cease to be one of knowledge. In this sense, knowledge depends on its object.

Yet knowledge and the object of knowledge do not constitute a simultaneous relative-correlative pair, because they fail condition (b) and, by the same token, (d). The fact that something is an object of knowledge does not, Aristotle holds, imply that it is actually known, but only that it *can* be. In other words, Aristotle takes the thing that knowledge is essentially related to be a knowable rather than a known.[25] Hence we cannot reason that the existence of an object of knowledge implies the existence of knowledge of it. That

23. οὐκ ἐπὶ πάντων δὲ τῶν πρός τι ἀληθὲς δοκεῖ τὸ ἅμα τῇ φύσει εἶναι· τὸ γὰρ ἐπιστητὸν τῆς ἐπιστήμης πρότερον ἂν δόξειεν εἶναι [...] τὸ μὲν ἐπιστητὸν ἀναιρεθὲν συναναιρεῖ τὴν ἐπιστήμην, ἡ δὲ ἐπιστήμη τὸ ἐπιστητὸν οὐ συναναιρεῖ· ἐπιστητοῦ γὰρ μὴ ὄντος οὐκ ἔστιν ἐπιστήμη, – οὐδενὸς γὰρ ἔτι ἔσται ἐπιστήμη, – ἐπιστήμης δὲ μὴ οὔσης οὐδὲν κωλύει ἐπιστητὸν εἶναι, *Cat.* 7, 7b.22–31.

24. On the sense of "something" here, see the next section.

25. Cf. *Met.* I.6, 1057a.10–12. Aristotle's word for "object of knowledge" (ἐπιστητόν) is a verbal adjective ending in -τός used denominatively. In addition to having the meaning of a perfect passive participle ("the known"), an adjective ending in -τός can express possibility ("the knowable"), as I am taking it to here. See Smyth (1956), p. 157.

means that we also cannot reason as in the case above that the destruction of the relative, knowledge, would undermine the status of what is known as object of knowledge. Instead, the object of knowledge can both pre- and post-exist knowledge of it.[26] Aristotle illustrates this with a string of rather striking examples:

> **T8** Take, for example, the squaring of the circle, supposing it to be an object of knowledge. Knowledge of it does not yet exist, but the object of knowledge itself exists.[27]

Aristotle assumes that it is possible to "square the circle," that is, to construct a square equal in area to a given circle.[28] His point does not, however, turn on this: Aristotle could have equally well chosen a mathematical result that in fact holds but had not yet been

26. Simplicius has a different interpretation. He takes all relatives to be simultaneous in nature. In order to make this fit with the text, he points to Aristotle's use of the word "seems (δοκεῖν)" in stating his conclusions at 7b.24 and 12 and claims on this basis that the counterexamples Aristotle presents are not meant as genuine counterexamples to the simultaneity of relatives (Simplicius *in Cat.* 7, 193,33–4). But Aristotle's conclusion that "in *most* cases it is true" (καὶ ἐπὶ μὲν τῶν πλείστων ἀληθές ἐστιν, 7b.15–16, my emphasis) that relatives are simultaneous in nature is unhappy on Simplicius's reading, since this carries the conversational implicature that there are *some* cases in which it is not true. If Aristotle took it to be true in all cases, we would expect him to say that it was in *all* cases true. Thus I will work under the assumption that Aristotle means to endorse these as genuine counterexamples. The use of "seems (δοκεῖ)" can be explained, as Simplicius himself notes (*in Cat.* 7, 189,27–29), in other ways: as an expression of uncertainty, or, more plausibly, as expressing that it is widely (but, Aristotle thinks, falsely) believed that all relatives are simultaneous in nature.

27. οἷον καὶ ὁ τοῦ κύκλου τετραγωνισμὸς εἴγε ἔστιν ἐπιστητόν, ἐπιστήμη μὲν αὐτοῦ οὐκ ἔστιν οὐδέπω, αὐτὸ δὲ τὸ ἐπιστητὸν ἔστιν, *Cat.* 7, 7b.31–33.

28. Aristotle refers to a purported proof of the squaring of the circle by Bryson at *Post. An.* I.9, 75b.40–41. He does not seem to deny the validity of the argument, but he denies that it is a demonstration and thus a proof in his own technical sense, viz. an argument which imparts scientific knowledge. Thus, Aristotle as a matter of fact seems to hold that it is actually possible to square the circle, but he thinks that no one yet had scientific knowledge of it, because no one had yet provided an argument that counts as a demonstration by his lights. See *Post. An.* I.9, 75b.40–76a.3 alongside *Soph. El.* 171b.12–18 and 172a.2–7. For a good summary of the evidence we have about Bryson and his attempt to square the circle see Wasserstein (1959).

proven. Let us nevertheless work with his example of squaring the circle. The "object of knowledge" here is the fact that a circle is capable of being squared.[29] Assuming that it is possible to square the circle, condition (b) of simultaneity fails for the pair of relatives <knowledge of squaring the circle, squaring the circle>, since, on the one hand, the state of affairs that a circle is squareable obtains (or "exists"), and is thus an object of knowledge in the sense that it is something someone might know, but knowledge of it does not yet exist, because the only way this knowledge could exist would be by it existing "in" someone's soul – that is, if someone actually knew it.[30]

This case illustrates one way in which simultaneity may fail for knowledge and its object. His other example illustrates a different type of failure, a failure of condition (d):

> **T9** Again, if an animal ceases to exist its knowledge will not exist, but there may still be many of the objects of its knowledge.[31]

Aristotle has us consider what takes place upon the death of an animal that knows something. The animal's death is sufficient for its knowledge perishing, because knowledge, as well as being dependent on its object, is dependent on the life of the animal: Knowledge can only exist "in" a primary substance, the soul belonging to the one whose knowledge it is.[32] Yet the death or other cognitive harm to an animal with knowledge need induce no

29. It bears emphasizing that this is not an "object" in the sense of a "thing" or even an abstract object like a circle or a square. It is a complex consisting of a general kind (circles) and a counterfactual property of them (the ability to be inscribed in a square). I will return to this below.

30. Cf. Philoponus *in Cat.*, 121,15–16.

31. ἔτι ζώου μὲν ἀναιρεθέντος οὐκ ἔστιν ἐπιστήμη, τῶν δ' ἐπιστητῶν πολλὰ ἐνδέχεται εἶναι, *Cat.* 7, 7b.33–35.

32. This point is emphasized by Morales (1994, 261) and Hood (2004, 7–8).

change in the object of its knowledge, the worldly states of affairs that it knows.[33] Nor do these cease to be objects of knowledge in the relevant sense: They remain intelligible, ready to be known by others, even though they are no longer actually known by that animal. Knowledge thus fails to be simultaneous in nature with its correlative, because an object of knowledge remains an object of knowledge (a knowable) even after the one who knows it is annihilated.[34]

Unlike the double and the half, then, knowledge and the object of knowledge are not

33. On an alternative reading, suggested by the translation of Ackrill (1975, 21) and taken by Bodéüs (2001, 126), Aristotle is considering a scenario in which the entire genus of animal perishes, rather than one particular animal (cf. *Cat.* 13, 15a.6–7). In this case, Aristotle's point is all the more emphatic: Even if *every* animal were to go out of existence, many of the things that these animals knew would remain the same.

34. Simplicius, in line with his view that all relatives are simultaneous in nature (see note 26 on p. 43), takes this to be a merely apparent counterexample to the simultaneity of relatives. He remarks: "one should compare what is potential with what is potential, and what is actual with what is actual, and in this way say that relatives are simultaneous [sc., in all cases]" (Simplicius *in Cat.* 7, 196,29–30, trans. Fleet). Simplicius's remark is embedded in a complex discussion of the views of Philo and Diodorus, which it would exceed the scope of this paper to consider here, but his idea seems to be that we can distinguish between an actual and a potential object of knowledge, and that the actual object of knowledge is the correlative of actual knowledge, while the potential object of knowledge is the correlative of potential knowledge. Both of these relative-correlative pairs (potential knowledge/potential object of knowledge, actual knowledge/actual object of knowledge) are, Simplicius takes it, in fact simultaneous. Since the actually knowing animals and the potential objects of knowledge do not form a relative-correlative pair, this is not a genuine counterexample to the simultaneity of relatives. If all animals cease to exist, Simplicius holds, then both *actual* objects of knowledge and *actual* knowledge are removed, but *potential* knowledge and *potential* objects of knowledge remain unchanged (*in Cat.* 7, 196,15–19). However, it is not clear why removal of all of the animals removes only actual knowledge and not also potential knowledge, since the capacity of all of these animals to know is also, presumably, thereby destroyed. As a Neoplatonist Simplicius is perhaps more comfortable with potential knowledge existing absent any potential knower than Aristotle would be. Simplicius bolsters his reading by appealing to the knowledge that remains "in the unmoved cause" (*in Cat.* 7, 194,24) after animals are all destroyed, but he himself seems to admit that this reading is difficult to square with the text when he claims that Aristotle "sets this out better and more systematically in the *Metaphysics*" and says what he says here only "to exercise the minds of his readers" (Simplicius *in Cat.* 7, 196,3–10, trans. Fleet).

on a par as relatives. Aristotle elaborates this in his treatment of relatives in *Metaphysics* Δ.15, where he draws a distinction between relatives which are "relative in virtue of just what they are being said to be that which it is in of something else"[35] and those which are only relatives because "something else is said to be relative to it."[36] Relatives of the first type, which we may call "essential" relatives,[37] are those that are principally theorized in *Categories* 7: Relatives which are "just what they are" by being of something else.[38] The object of knowledge is given as an example of the latter type of relative in *Metaphysics* Δ.15 as well, along with the object of thought[39] and the object of measurement.[40] These are called relatives only by courtesy of having something else that is essentially relative being relative to them. That is, the object of knowledge is said to be a relative only by courtesy of something else, namely knowledge, being relative to *it*. That gives it the superficial semantic features of a relative (an object of knowledge is said to be the object of knowledge 'of' some pieces of knowledge), but it lacks the metaphysical dependence on its correlative characteristic of essential relatives. Unlike knowledge itself, the object of knowledge has an essence specificable independently of any particular animal's knowledge of it. That is why the object of knowledge may survive as an object of knowledge through the loss of its correlative, while knowledge itself may not survive the loss of its correlative object. To be a piece of knowledge just *is* to be a mental state that is appropriately related to its object. To remove this object is *ipso facto* to dismantle the grounds for calling that mental state knowledge.

The main claims of *Categories* 7 and *Metaphysics* Δ.15 as they regard knowledge are

35. πρός τι τῷ ὅπερ ἐστὶν ἄλλου λέγεσθαι αὐτὸ ὅ ἐστιν, *Met.* Δ.15, 1021a.27–28.

36. τῷ ἄλλο πρὸς ἐκεῖνο, *Met.* Δ.15, 1021a.28–29.

37. I am not claiming that this coincides with what Aristotle calls relatives καθ' ἑαυτὰ at 1021b.3–4.

38. *Cat.* 7, 6a.36 (T5).

39. διανοητὸν, *Met.* Δ.15, 1021a.31.

40. μετρητὸν, *Met.* Δ.15, 1021a.29.

therefore the following: (1) Knowledge is essentially relative, (2) as such, part of what it is to be an instance of knowledge is to bear an appropriate relation to its correlative, the object of knowledge, and so (3) something being an instance of knowledge implies the existence of something that is its object; (4) the object of knowledge is also a relative, however only by courtesy, and so (5) the existence of the object of knowledge does not imply that there is any knowledge of it. From (3), Aristotle infers what I will call a *dependency* principle about knowledge:

> If K is knowledge of O, then K cannot exist as an item of knowledge without something being O.[41]

## Precisifying the dependency principle

In order to better understand the import of these claims, we must ask: What sort of thing does Aristotle mean by the "object of knowledge"? And what does it mean for there to be something that "is" the object of a given piece of knowledge? We might assume that Aristotle is talking about objects in the sense of primary substances – things like Socrates, the moon, or a vine. Aristotle's dependency principle would then say that knowledge of Socrates, for instance, requires there to be something that is Socrates, i.e., for Socrates to exist. But further examination suggests that this is not what Aristotle means. Aristotle uses the word "object of knowledge" (ἐπιστητόν) interchangeably with "what we know."[42] If I know that the earth revolves around the sun, then *what* I know is neither the sun nor the earth, but the whole state of affairs we would express with a *that* clause in English. What I know is *that* the earth revolves around the sun. The fact that Aristotle uses the expression "what we know" interchangeably with "object of knowledge" suggests that he

41. Cf. Kiefer (2007, 31–32).

42. As in *Post. An.* I.6, 74b.5–6 and T14, below. The spurious *Magna Moralia* says that "knowledge is about the object of knowledge" (ἡ μὲν οὖν ἐπιστήμη ἐστὶ περὶ ἐπιστητόν, 1.34.8.1), but Aristotle generally avoids such locutions; see however *Post. An.* I.33, 88b.34.

means "object of knowledge" in the sense of an object that corresponds to a *that* clause in English, rather than the sense that corresponds to a name or definite description.[43]

This fits with Aristotle's usage in the *Posterior Analytics*. There, the object of knowledge is what one knows when one grasps the premise or conclusion of a demonstration.[44] The premises and conclusions of demonstrations are predicative sentences: Something of the form "S holds of P." *What* one thereby grasps is presumably neither S, nor P, but *that S is P*. Aristotle's explicit examples of objects of knowledge are scarce, but they tend to confirm that he is thinking of the object of knowledge in this way. The only clear example Aristotle gives is in *Categories* 7, "the squaring of the circle."[45] While the circle may be a substance, the squaring of the circle is plainly not.

In a careful study, Paolo Crivelli has shown that Aristotle uses this type of grammatical construction, in which a predicable in the genitive modifies a noun denoting a subject, to

43. Prior (1971, 3) begins his study of propositions by making essentially the same distinction I am making here for the expression "object of thought." In one sense, if I think "the grass is green," the object of my thought is what I think *about*: The grass. In another sense, it is *what I think*: That the grass is green. I am arguing that Aristotle uses "object of knowledge" in a way parallel to the latter.

44. Usually the conclusion, as in *Post. An.* I.24, 86a.6–7, but see 73b.16–18.

45. See T8. At *Top.* IV.4, 125b.4, it is at counterfactually suggested that a man or a soul may be the object of knowledge. But the context there means we should not place too much weight on this: Aristotle may be talking about the types of things that others may give as an object of knowledge, rather than the types of things that he thinks are properly described as objects of knowledge. Together with *Cat.* 7, 7b.31, these are the only places in the corpus where Aristotle gives an explicit example of the type of thing he means by "object of knowledge."

denote a state of affairs rather than a substance or an "individual compound."[46] I will follow Crivelli here, and take Aristotle's objects of knowledge generally to be states of affairs rather than substances.[47] As Crivelli explains, a state of affairs, for Aristotle, corresponds to an affirmative predicative assertion.[48] It can exist in a state of "combination" or "division."[49] A state of affairs is "combined" when the corresponding predicative assertion is true.[50] It is "divided" when the predicative assertion is false.[51] Aristotelian states of affairs are thus not static entities: They exist in states of combination at certain times, division at others. The corresponding utterances or thoughts take on different truth-values depending on the condition of the state of affairs, as Aristotle explains in *Categories* 5:

46. An "individual compound" (sometimes called a "predicational complex" or "cooky object") is a dependent individual that exists precisely at those times when some substance has some property. Paradigms are "the musical Corsicus" and "the sitting Socrates." These are non-identical with the substances Corsicus and Socrates for Aristotle, but they bear a relation of accidental sameness to them. Aristotle tends to denote these with a predicate in the same case as the noun it modifies. See Matthen (1983, 125) and further Lewis (1991) and Matthews (1982). Crivelli's argument relies mainly on an analysis of *Met.* Δ.29, 1024b.17–21, where Aristotle speaks of "the diagonal's being commensurable" (τὸ τὴν διάμετρον εἶναι σύμμετρον) and "your being seated" (τὸ σὲ καθῆσθαι). See Crivelli (2004, 46–49).

47. The fact that Aristotle will occasionally refer to the object of knowledge as a "thing" (πρᾶγμα), as at *Post. An.* I.2, 71b.11, is no argument against this. For Aristotle, πράγματα encompass both what we might more comfortably call "objects" and states of affairs. See Crivelli (2004, 47, 140), and Bronstein (2016, 54) and the references given there. See Liddel, Scott and Jones meaning III.1 of the entry for πρᾶγμα on this usage in other authors.

48. Crivelli (2004, 49–50).

49. Crivelli (2004, 55–56).

50. Crivelli (2004, 55).

51. Crivelli (2004, 55). Crivelli claims that, in addition to being combined and divided, Aristotelian states of affairs may be said to be true and false. For a powerful case against this view, see Charles and Peramatzis (2016). See also my discussion of truth-bearers in chapter four.

**T10** The same sentence seems to be both true and false, for example, if the sentence that someone is sitting is true, then the same sentence will be false when they get up. Likewise with beliefs: If someone truly believes that someone is sitting, they will have a false belief about them if they have not changed their mind when the person gets up.[52]

Where a contemporary philosopher might take there to be a *different* state of affairs corresponding to the assertion that Socrates is seated now, when he is, and that he is seated later, when he is not, Aristotle prefers to think of these two utterances as corresponding to the same state of affairs. The very same state of affairs may at one time make a sentence or belief true (when Socrates is "combined" with sitting) and false at another (when Socrates is "divided" from sitting). Aristotle infers that the utterances or beliefs may bear a different truth-values at different times. While Aristotle goes on below to explain that the reception of truth-values at different times does not constitute a *change* in the strict sense, since only substances can undergo changes strictly speaking,[53] he maintains that a belief or sentence with the same content may have a different truth-value at different times, owing to the condition of the corresponding state of affairs.[54]

Aristotle uses the copula with a state of affairs to indicate that it is in a state of combination rather than division.[55] That is, for a state of affairs like the squaring of the circle to "be" is for the circle to be combined with the property of being squareable; for it *to be the case* that the circle is squareable. Thus, when Aristotle talks about the object of knowledge "being," he does not mean that some substance this knowledge is about exists. He rather means that the state of affairs *obtains*. This means that the dependency condition

52. ὁ γὰρ αὐτὸς λόγος ἀληθής τε καὶ ψευδὴς εἶναι δοκεῖ, οἷον εἰ ἀληθὴς εἴη ὁ λόγος τὸ καθῆσθαί τινα, ἀναστάντος αὐτοῦ ὁ αὐτὸς οὗτος ψευδὴς ἔσται· ὡσαύτως δὲ καὶ ἐπὶ τῆς δόξης· εἰ γάρ τις ἀληθῶς δοξάζοι τὸ καθῆσθαί τινα, ἀναστάντος αὐτοῦ ψευδῶς δοξάσει τὴν αὐτὴν ἔχων περὶ αὐτοῦ δόξαν, *Cat.* 5, 4a.23–28.

53. *Cat.* 5, 4a.28–4b.1.

54. On this see further Hintikka (1973, 62–68).

55. Crivelli (2004, 54). See also my discussion of T53 on p. 155.

should be read as describing the connection between the existence of a state of the soul as knowledge and the obtaining of its object. This is not simply the factive property of knowledge, because the condition is implicitly temporal. It is implicitly temporal because Aristotle takes one and the same content to be capable of having a different truth-value at a different time. Thus, what the dependency condition amounts to is this: If a soul has some knowledge K, then that soul's condition is a condition of knowledge only *at those times* when the state of affairs known actually obtains. An intrinsically identical condition of the soul might continue to exist, but it would not continue to exist *as* a state of knowledge; it would become mere ignorance if what one knows were to cease to obtain.[56]

### *2.1.2 Knowledge as a state:* Categories *8*

The subsequent chapter, *Categories* 8, places knowledge in the category of *quality*. Aristotle distinguishes, as one sense of "quality," "*states* and *conditions*,"[57] giving "instances of knowledge and virtues"[58] as examples of "states." Hence, in addition to being categorized as a relative, knowledge is also classified in the category of quality, and in particular as the type of quality Aristotle calls a "state" (*hexis*).

There is evidence that this "doubling up" on the category of knowledge is conscious and deliberate on Aristotle's part. On the one hand, Aristotle had already noted in *Categories* 7 that there are "states" and "conditions" in the category of relative.[59] On the other hand, Aristotle tells us at the end of *Categories* 8 that "if the same thing really is a quality and a relative there is nothing absurd in its being counted in both genera."[60]

56. Cf. *Met.* Z.15, 1039b.32–33.

57. ἕξις καὶ διάθεσις, *Cat.* 8, 8b.26–27.

58. αἵ τε ἐπιστῆμαι καὶ αἱ ἀρεταί, *Cat.* 8, 8b.29.

59. *Cat.* 7, 6b.2.

60. *Cat.* 8, 11a.37–38. I discuss this passage, and the textual problems associated with it, on p. 62 in note 99.

Given the preceding analysis of what it means to call knowledge a relative, it should indeed not seem absurd to us if it belongs to the category of quality as well. Aristotle's conception of quality is broad: A quality is anything that can be predicated of a subject "to say what sort of thing it is."[61] In this broad sense of "quality," qualities with a relational component are common. To call a vehicle *roadworthy*, for instance, is at least in part to say that it is deemed acceptable for use on roads by some country's road authority; hence to say that it bears the relation of *being officially approved for road travel* to the relevant institution or officials within it. In general, there is no reason why saying that something stands in a certain relation cannot be a way of qualifying it, and hence no reason why a relative cannot also be a quality.

We can make this more concrete in the case of knowledge. Since knowledge is a relative, but not a *simultaneous* relative, for something to be an item of knowledge is only *in part* for it to bear an appropriate relationship to its object. A complete account of knowledge could perhaps be expected to take the form

> A certain type of cognitive condition of a soul / bearing an appropriate relation
> to the object of this cognitive condition.

In considering knowledge as a relative, Aristotle had focused on the latter part: To be knowledge is *in part* to bear an appropriate relation to an object. Calling knowledge a quality draws attention to the former part: Knowledge is a certain *quality* because it is used to qualify the state of an animal on the basis of a quality of its soul. This is a quality, to be sure, that an animal only counts as having when it also bears a certain relation to an external state of affairs – but a quality all the same.

There is thus no tension between Aristotle's claim that knowledge is a relative and his

61. ποιότητα δὲ λέγω καθ' ἣν ποιοί τινες λέγονται, *Cat.* 8, 8b.25. For an excellent treatment of Aristotle's category of quality, see Studtmann (2003).

claim that knowledge is a quality, properly understood.[62] A tension does however develop as Aristotle goes on to elaborate the place of knowledge within the category of quality. As noted above, Aristotle gives knowledge as an example of the type of quality he calls a "state" (*hexis*). He distinguishes states from more superficial qualities of a subject, qualities a subject can gain and lose without undergoing any other non-superficial changes. These, like a person's blushing or being angry, tend to be short-lived, and are easily gained and lost without harm or significant effort on the part of their bearer. Aristotle focuses on the transient character of this type of quality, and calls this class of qualities "conditions."[63] A state, by contrast

**T11** differs from a condition in being more permanent and long-lasting.[64]

The differentiae that mark out states from conditions are given here in terms of two notions of persistence or durability: States are more "permanent"[65] and "long-lasting"[66]. Aristotle goes on to explain why knowledge is a state rather than a condition:

**T12** Knowledge seems to be something very abiding and steady whenever someone has even a reasonable grasp of their knowledge, so long as no great change comes about by illness or something else of this sort.[67]

Aristotle takes knowledge to be a state, rather than a condition, because it is "abiding"

62. This may come as a surprise to those who view the categories as an exclusive taxonomy. For a persuasive case that the textual evidence does not support taking Aristotle's categories to be an exclusive taxonomy, see Morrison (1992).

63. διάθεσεις, 9a.8–10. Aristotle uses the term διάθεσις in a number of other ways in *Categories* 8 as well: For discussion see Studtmann (2003).

64. διαφέρει [...] διαθέσεως τῷ μονιμώτερον καὶ πολυχρονιώτερον εἶναι, *Cat.* 8, 8b.27–28.

65. μονιμώτερον, 8b.28.

66. πολυχρονιώτερον, 8b.28.

67. ἥ τε γὰρ ἐπιστήμη δοκεῖ τῶν παραμονίμων εἶναι καὶ δυσκινήτων, ἐὰν καὶ μετρίως τις ἐπιστήμην λάβῃ, ἐάνπερ μὴ μεγάλη μεταβολὴ γένηται ὑπὸ νόσου ἢ ἄλλου τινὸς τοιούτου, *Cat.* 8, 8b.29–32.

and "steady."[68] Having knowledge in this sense is not like being cold or hot, qualities which someone might gain or lose by stepping outside.[69] Instead, it requires someone to "grasp"[70] something. One's grasp of this thing must be sufficiently steady, firm or reliable that only an "illness or some other such thing"[71] could cause an animal to lose knowledge.

In order to get more clearly into view what sense of "knowledge" Aristotle means here, it is worth dwelling on Aristotle's comparison of this type of knowledge, in respect of its permanence and long-lastingness, with virtue. Aristotle goes on to say that virtues are steady and abiding like knowledge is: "justice, temperance, and the rest seem to be not easily changed."[72] Aristotle takes virtue to be the outcome of a good upbringing, a process of habituation.[73] Once acquired, virtue becomes part of a person's character.[74] Any change to an adult's virtue would thus *ipso facto* entail a change to an adult's character: A type of change which is rare and extreme, if possible at all.[75] Of course, Aristotle does not take the virtuous person to be on this account *infallible*. Good people can make poor decisions under the influence of emotions, drugs or appetites.[76] This means that virtue cannot be identical with the particular judgements about what is right in a given

68. I have chosen "abiding" as a translation of παραμόνιμος and "steady" as a translation of δυσκίνητος in order to capture the connotation of reliability or steadfastness, both of which I believe Aristotle means to convey here. This language mirrors the terminology used to describe the value of *epistēmē* as compared with *doxa* in the *Meno* (97d.10, 97e.4, 97e.9, 98a.1).

69. *Cat.* 8, 8b.35–37.

70. λάβῃ, *Cat.* 8, 8b.31.

71. *Cat.* 8, 8b.32.

72. *Cat.* 8, 8b.33–35; cf. *Nic. Eth.* I.10, 1100b.12–17, II.4, 1105a.33.

73. *Nic. Eth.* II.1, 1103a.14–19.

74. *Nic. Eth.* I.13, 1103a.3–4.

75. See *Nic. Eth.* I.10, esp. 1100b.15–22, 28–33.

76. *Nic. Eth.* VII.3, 1147a.14–18.

circumstance. Instead, virtue brings a capacity to *generally* make such judgments well.[77] What is impervious to change is not, then, each concrete practical decision of the virtuous person but rather her abiding ability to make practical decisions well in general.

Similarly Aristotle draws a distinction between theoretical knowledge as a abiding *hexis* and knowledge as an occurrent mental state, referred to variously as "using" knowledge,[78] "knowledge in actuality,"[79] "knowing by the particular."[80] The *hexis* of knowledge is a cognitive condition that, like ethical virtue, comes about only through a protracted process of learning that Aristotle calls "experience" (*empeiria*) and which, once acquired, manifests as a permanent feature of the animal's soul.[81] Only by harming the cognitive faculties by which the soul operates can we erase someone's knowledge in this sense. Knowing in the latter sense consists in *applying* what one knows in the former sense to a particular encountered in thought or in experience and thus explaining its specific features.[82] For example, one might have knowledge in the former sense that no mules are pregnant; Aristotle does not deny that there is however also sense in which one can know that a particular mule is

77. *Nic. Eth.* VI.7, 1141b.9–10, 12–15. Note especially the description of the good deliberator as στοχαστικὸς, and the implication in the following sentence that this consists in the grasp of some universal.

78. χρώμενον, *Met.* Δ.7, 1017b.3, χρῆσθαι, *Eud. Eth.* II.9, 1225b.11, *Top.* V.2, 130a.19, 22, χρώμενος, *Nic. Eth.* VII.3, 1146b.31, χρήσεως, *Phys.* VII.3, 247b.7. See also *Protrepticus* 74.4–6, where this type of knowledge is equated with contemplation (θεωρεῖν).

79. ὡς τῷ ἐνεργεῖν, *Pr. An.* II.21, 67b.3, ἐντελεχείᾳ, *De An.* II.5, 417a.29, ἐνεργείας, *Phys.* VII.3, 247b.6.

80. τῇ καθ' ἕκαστον, *Pr. An.* II.21, 67a.21. Confusingly, Aristotle calls this knowing "without qualification" (ἁπλῶς) at *Post. An.* I.1, 71a.28. This is to be distinguished from the meaning of the same locution at *Post. An.* I.2, 71b.9, which refers to the state.

81. Cf. *Pr. An.* I.30, esp. 46a.18–24 and *Nic. Eth.* VII.3, 1147a.22–24.

82. *Pr. An.* II.21, 67a.21. Plausibly also *Post. An.* I.1, 71a.25; Aristotle appears to avoid using the word *epistasthai* to refer to this in other parts of that passage, however. See also *Post. An.* I.8, 75b.24–26, where such knowledge is said to be merely "accidental."

therefore pregnant,[83] but he takes this to be a distinct *type* of knowledge, and thinks of it as the *exercise* of one's knowledge of the universal fact in a particular perceptual circumstance.[84] Aristotle does not take the latter type of knowledge to be steady and abiding in the same way as the state: He makes the strong claim that we *only* have such knowledge when we are actively attending to the objects we are applying our knowledge to.[85] The state itself, however, is extremely difficult to dislodge; it is not, in the normal course of events, lost.

This is not to say that knowledge, in the sense that manifests a cognitive virtue, may not, like ethical virtue, on occasion be inhibited. Revelers at the symposium might, say, drink so much as to be unable to "piece together" an explanation. But Aristotle will not say that the cognitive virtue the revellers have is at any point *lost* when this happens. Rather, as in the practical case, the possession of the virtue is not enough to ensure that one always exercises it when it is called for.[86] That the drunk botanist cannot explain why broad leaved plants shed their leaves would mean, on Aristotle's analysis, that she is too drunk to "employ" or "make use of"[87] the knowledge that she has. And so, while he will grant that there is a *sense* in which such a person does not at that time know,[88] he also maintains that there is another sense in which the person still knows but fails to manifest or employ her knowledge. It is knowledge in this latter sense that is steady and abiding.

It is frustrating that Aristotle does not specify the class of "other such thing[s]" besides

83. *Pr. An.* II.21, 67a.36–37. In *Post. An.* I.1, Aristotle uses the example of learning that a particular figure in a semicircle is a triangle: See further McKirahan (1992, 177–87) on this type of example.

84. *Pr. An.* II.21, 67b.8–11.

85. *Pr. An.* II.21, 67a.39–67b.1.

86. Compare *Nic. Eth.* VII.3, 1047a.13–14. For some reasons to think that Aristotle's points there are not restricted to practical knowledge, see Morison (2012).

87. χρῆσθαι, 1147a.12.

88. Cf. *Nic. Eth.* VII.3, 1137a.12–13: "in a way [the drunkard] has and does not have [knowledge]."

illness that are capable of erasing knowledge, since this will turn out to be important for his argument. His example, illness, is however telling. Illness is for Aristotle paradigmatic of the sort of process that occurs outside of an animal's control.[89] When an animal falls ill, the vital processes and states that normally characterize its life may break down. In this way a sickness compromises or interrupts an animal's life, making it a sort of "acquired old age."[90] The pertinent feature of illness in this context cannot be that it is acquired, since then Aristotle's claim that we only lose knowledge through something like illness would rule out loss of knowledge by mental deterioration naturally occurring in old age, which Aristotle does appear to recognize.[91] Instead, the point of adverting to illness as a paradigm of the sort of change that could cause one to lose knowledge is presumably to emphasize that such a change must constitute a degeneration of the animal's cognitive faculties. A mere change in external circumstance, a run-of-the-mill perceptual encounter, or, in general, any bodily change that is compatible with the animal's normal, healthy functioning will not cause the animal to lose knowledge in the relevant sense. Only a change that causes some sort of harm or represents some sort of degeneration can bring

89. Cf. *Nic. Eth.* 1114a.25–28, 1145a.31, 1149a.4–12.

90. See *Gen. An.* 784b.30–32: "Disease may rightly be called acquired old age [γῆρας ἐπίκτητον], and old age natural disease [νόσον φυσικήν]."

91. See *De Mem.* 450b.1–8, also *Long. Vit.* 2, 465a.19–23.

about a loss of knowledge.[92]

*Categories* 8 thus yields what we can call a *durability principle*:

> If S knows O, then S continues to know O so long as she experiences no detrimental changes to the constitution of her cognitive faculties

In saying this, part of what Aristotle means to rule out is that we change our minds about the things we know. If one knows something in the relevant sense, then one takes oneself to have apodeictic proof for it, and takes the principles from which one proves it to be most certain of all,[93] such that one is incapable of being persuaded out of what one knows to be true.[94] Yet this, which we may call the *subjective* stability of knowledge is not the only sense in which Aristotle is saying that knowledge is durable here. In interpreting Aristotle's claim, we must keep in mind that the content of an intensional state like knowledge belongs to a broader class of contents that may take on a different truth-value on account of the states of affairs that they represent coming to obtain or ceasing to obtain. Part of what Aristotle is ruling out here, and thus part of knowledge's being a durable in this sense, is that it may not be lost on account of changes in the states of affairs it represents. That knowledge be stable in this sense reflects not so much the

92. We might today think of a brain injury or a degenerative condition. Bodéüs (2001, 133), taking "knowledge" here broadly to include also practical knowledge, suggests that Aristotle might have added the "bestial" (θηριώδη) affections discussed at *Nic. Eth.* VII.6, 1149a.6ff. I am more circumspect: In contrast to illness, which is also discussed in that passage, bestial affections are not described as leading to *loss* of practical knowledge; rather, Aristotle invokes bestial affections to explain why certain people never acquire practical knowledge to begin with. On this point compare also the pseudo-Aristotelian *Divisiones Aristotelae*, which recognizes three types of circumstance in which there is "loss of knowledge" (ἀποβολὴ τῆς ἐπιστήμης, 62.15): destruction of that of which there is knowledge (ἐὰν φθαρῇ οὗπέρ ἐστιν ἡ ἐπιστήμη, 62.16), forgetting (ἐὰν λήθη γένηται, 62.16), and destruction of the one who has the knowledge (ἐὰν ὁ ἔχων τὴν ἐπιστήμην φθαρῇ, 62.17). See the discussion in the next section regarding whether forgetting in fact constitutes a change of the relevant sort.

93. *Post. An.* I.2, 72a.37–72b.3.

94. ἀμετάπειστον, *Post. An.* I.2, 72b.3–4.

intuition that it is deeply held, but rather the intuition that it is permanently reliable. We may call this the *objective* durability of knowledge.

### *2.1.3 The tension between the two principles*

The objective durability of knowledge stands in tension with Aristotle's claim in *Categories* 7 that knowledge is a relative. That discussion gave the impression that, far from being "permanent," knowledge is rather precarious: One counts as having knowledge only when, in addition to one's faculties being in order, the object of one's knowledge continues for its part to be such as one knows it to be. We can ask: How is the requirement that knowledge be steady and abiding in such a way as to generally preclude being lost related to the claim that knowledge depends on the continued existence of an object of knowledge?

The point can be focused. The durability principle implies that only a breakdown in the cognitive machinery of someone who has knowledge can result in that person's loss of knowledge. A change in the object of knowledge is not a change of this sort: My psychic constitution is not affected in the manner of being struck down by an "illness" just because what I previously knew has changed. And yet the fact that knowledge is a relative means that this sort of extrinsic change ought to be sufficient for losing knowledge.[95] How can (or, can?) Aristotle hold this consistently?

I noted above that Aristotle distinguishes two senses of *epistēmē*, the word I have been translating as "knowledge," one denoting the slowly acquired transformation of the soul in virtue of which one is able to exercise certain cognitive capacities, and another denoting the condition one is in when everything is in place to exercise them. What abides and

95. Aristotle seems reluctant to count this as a *change* (*kinēsis*) to the mental state in his technical sense (see *Cat.* 5, 4a.21–4b.19), but he is explicit in that passage that a belief that $p$ may go from true to false when $p$ ceases to obtain, and so I will talk of changes or transitions in truth-value here, even though these would not count as *kinēseis* in Aristotle's strict sense. On this notion of changing truth see Hintikka (1973) and Crivelli (2004, 45–77).

resists change is, for Aristotle, only knowledge in the former sense. It may seem natural to suppose, conversely, that it is only knowledge in the latter sense that has an object and thus is a relative. For whereas my ability to judge that, say, Socrates is healthy plausibly depends on the ongoing existence of Socrates, my medical ability to judge in general when people are healthy does not require the existence of Socrates or anyone else. For me to have the *capacity* to make such judgements, someone might say, means only that I will be able to make certain judgements about humans *if humans exist*; it does not require that there *actually presently be* humans.

This may suggest that the problem we have been dealing with will turn out to have been merely lexical: It is only because the word "*epistēmē*" is used in one sense to denote a state of capacity and in another sense for its deployment that we end up listing "*epistēmē*" in two categories. That would be no more mysterious than the fact that we use "healthy" to describe both a condition of the body and the things conducive to that condition.[96]

Yet things are not so simple. For on Aristotle's account, knowledge in *both* these senses is a relative. Recall again the grounds for placing knowledge in this category: Knowledge is a relative because knowledge is always knowledge *of* something. Any mention of someone's knowledge presupposes an answer to, or else prompts the question, what it is knowledge *of*. For Aristotle, this is true of the underlying cognitive state no less than it is true of the manifestation of the capacities associated with this state in a particular case. This means that even if we restrict our attention to knowledge in the sense of a *state*, we still face the problem discussed in the last section: Since it is a state, knowledge in this sense ought to be capable of being lost only with injury to its possessor, but as a relative, the state of knowledge ought to be liable to expire on account of its object, without any intrinsic change in its possessor. This tension is not alleviated by pointing out that "knowledge" can also be used to denote the deployment or manifestation of this state.

96. Cf. *Top.* I.15, 107b.6–12.

Before proceeding to see how Aristotle does attempt to resolve this tension, we need to consider a passage which some commentators have interpreted as denying that a univocal notion of knowledge occupies both the category of relative and quality, and thus denying that Aristotle takes there to be any such issue in need of resolution. In *Categories* 8, Aristotle tells us that "we should not be disturbed lest someone should say that though we proposed to discuss quality we are counting in many relatives (since states and conditions are relatives)."[97] He addresses this concern as follows:

> **T13** For in almost all of these cases, the genus is said to be a relative, but none of the particulars are. For knowledge, a genus, is called just what it is, of something else (it is called knowledge of something); but none of the particular cases is called just what it is, of something else. For example literacy is not said to be literacy of something, nor music, music of something. Thus the particular cases are not relatives. But we are said to be qualified with the particular cases, since we have them (it is because we have some particular knowledge that we are said to be knowledgeable). Hence these – the particular cases, in virtue of which we are on occasion said to be qualified – would indeed be qualities; but these are not relatives.[98]

Aristotle makes a distinction here between the categorial status of particular kinds of knowledge like music and literacy and knowledge "as a genus," that is, knowledge as the

97. *Cat.* 8, 11a.20–23.

98. σχεδὸν γὰρ ἐπὶ πάντων τῶν τοιούτων τὰ γένη πρός τι λέγεται, τῶν δὲ καθ' ἕκαστα οὐδέν· ἡ μὲν γὰρ ἐπιστήμη, γένος οὖσα, αὐτὸ ὅπερ ἐστὶν ἑτέρου λέγεται, – τινὸς γὰρ ἐπιστήμη λέγεται. – τῶν δὲ καθ' ἕκαστα οὐδὲν αὐτὸ ὅπερ ἐστὶν ἑτέρου λέγεται, οἷον ἡ γραμματικὴ οὐ λέγεται τινὸς γραμματικὴ οὐδ' ἡ μουσικὴ τινὸς μουσική, ἀλλ' εἰ ἄρα κατὰ τὸ γένος καὶ αὗται πρός τι λέγεται· οἷον ἡ γραμματικὴ λέγεται τινὸς ἐπιστήμη, οὐ τινὸς γραμματική, καὶ ἡ μουσικὴ τινὸς ἐπιστήμη, οὐ τινὸς μουσική· ὥστε αἱ καθ' ἕκαστα οὐκ εἰσὶ τῶν πρός τι. λεγόμεθα δὲ ποιοὶ ταῖς καθ' ἕκαστα· ταύτας γὰρ καὶ ἔχομεν, – ἐπιστήμονες γὰρ λεγόμεθα τῷ ἔχειν τῶν καθ' ἕκαστα ἐπιστημῶν τινά· – ὥστε αὗται ἂν καὶ ποιότητες εἴησαν αἱ καθ' ἕκαστα, καθ' ἃς ποτε καὶ ποιοὶ λεγόμεθα· αὗται δὲ οὐκ εἰσὶ τῶν πρός τι, *Cat.* 8, 11a.23–36.

kind encompassing all of these particular types of knowledge.[99] He points out that the peculiarity of being in two categories does not apply to music, literacy, etc. This is because these are qualities alone, not relatives. For to say that someone is schooled in (or "has") music or is literate does not prompt any further question: Such an utterance is already semantically complete.[100] And so these do not count as relatives.

We may be tempted to infer from this that Aristotle holds that knowledge as a genus is, conversely, not a state, since this would give him a tidy solution to the puzzle: All knowledge is either knowledge as a genus or one of its qualities, and the genus is only a

99. Minio-Paluello (1949), *Praefatio*, v n.1 and Frede (1987, 13) hold lines 11b.10–16, which immediately precede this passage, to be suspect, and Bodéüs (2001, 50) transports these lines to just after 11a.38. Frede (1987, 13–17) argues for extending suspicion to this passage (specifically, to 11a.20–38), on grounds of style and content. I will make no attempt to address stylistic issues here. However, the reasons that Frede gives for doubting the authenticity of this passage on the basis of the doctrine it espouses are not convincing. Frede notes that, in a different passage (*Cat.* 7, 8a.13–8b.24), Aristotle goes to pains to avoid the conclusion that the same item is a relative and a *substance*, and so finds it surprising that Aristotle should be willing to allow the same item to be both a relative and a quality here. But there is an independent reason for Aristotle to wish to avoid the conclusion that relatives are substances: Relatives are posterior in nature to beings in the other non-substantial categories (*Met.* N.1, 1088a.24), while substances are prior to them in nature (*Nic. Eth.* I.6, 1096a.21). Hence we need not take Aristotle's desire to avoid the conclusion that some substances are relatives as the outcome of a general aversion on his part to assign the same item to multiple categories (cf. Morrison 1992). Rather, Aristotle may hold this view so as to avoid violating the antisymmetry of priority in nature. Frede's other reason for taking the content of this passage to be at odds with Aristotelian doctrine relies on the categories being interpreted as highest genera, and as such being mutually exclusive. But, as Frede (1987, 13) himself notes, the categories are only described as highest genera in the *Categories* at 11b.15, in a part of the text generally agreed to be suspect: On this further, see Bodéüs (2001, 141). My approach here will be to proceed under the assumption that 11a.20–38 is authentic and to argue that this passage is consistent with my reading. The passage is in not however required to establish my claim that Aristotle takes knowledge to be both a quality and a relative: This is already claimed at 6b.3 and 8b.29. If the passage should turn out to be inauthentic, this will not therefore affect the evidence for my argument. Since, however, I suspect the passage is authentic, I will explain how, properly understood, it is consistent with my reading and may be taken to provide further details of Aristotle's position on the categorial status of knowledge.

100. Cf. Morales (1994, 264).

relative (not a quality) while the species are only qualities (not relatives).[101] That would be to deny what I argued above, that knowledge *in the very same sense* is both a state and a quality.

But Aristotle does not deny that "knowledge as a genus" is a quality. He only affirms that it is a relative, and denies that its *species* are relatives. And, on reflection, it would cause problems for his view were he to deny this. For the criterion that Aristotle uses to argue that the particular types of knowledge are qualities is that we qualify people with them: We say someone is "musical" or "literate." We also qualify people with knowledge generally; indeed, "knowledge" is Aristotle's example of something "in" but not "said of" a subject.[102] The fact that such an attribution stands in need of semantic supplementation by a correlative does not imply that it is not used to qualify people, and hence does not imply that it is not a quality.

This is one reason to reject the reading that takes Aristotle to be solving the puzzle by denying that knowledge as a genus is a quality. Another reason to reject this reading is that it makes it very difficult to understand what Aristotle says next. He goes on: "Moreover, if the same thing really is a quality and a relative there is nothing absurd in its being counted in both the genera."[103] This is not the remark we would expect if Aristotle took himself to have just shown that nothing is really both a quality and a relative. Why go to the trouble of providing the argument if there is anyway nothing absurd in something

101. Elias endorses this interpretation very explicitly; see *in Cat.* 238,8–10 with Taieb (2016, 98–99).

102. Cf. *Cat.* 2, 1b.1 and *Cat.* 8, 10b.2. Porphyry (*in Cat.* 140,20) denies that the term "knowledge" is ever used to qualify someone with a particular type of knowledge like grammar or music, but he does not justify his claim. Olympiodorus (*in Cat.* 129,28) attempts to defend this claim by asserting that it is impossible for any one person to know everything; but this is clearly beside the point. When we say that someone has "knowledge" without further specification, we are clearly not saying that they know *everything*. On this further see Taieb (2016, 97).

103. ἔτι εἰ τυγχάνει τὸ αὐτὸ ποιὸν καὶ πρός τι ὄν, οὐδὲν ἄτοπον ἐν ἀμφοτέροις τοῖς γένεσιν αὐτὸ καταριθμεῖσθαι. *Cat.* 8, 11a.37–38.

occupying both categories?[104] His remark makes sense, however, under the assumption that he does *not* take himself to have established that there are no such "dual citizens." Instead, this remark makes clear that Aristotle's purpose in T13 is more modest: Aristotle only endeavours to clarify *which* items it is that belong to both categories, not to argue that there aren't any. His claim is only that such cases are less pervasive than we might first have thought, since the *species* of knowledge are only in the category of state.[105]

At this point, there is a break in the text, and we do not know how, or whether, Aristotle would have elaborated the claim that there is nothing absurd about the same thing being both a quality and a relative. It seems worth considering, however, that he may have gone on to discuss precisely how knowledge as a genus *is* both a state and a relative. In any case, the evidence in the text we do have should incline us against taking Aristotle to intend to limit his durability and dependency claims to two respective senses of

104. As Porphyry reads him (*in Cat* 140,24–141,5), Aristotle is offering an alternative, incompatible solution to the puzzle at 11a.37–8, but it is hard to see a further solution in Aristotle's flat assertion that there is nothing absurd in the same thing being counted in both genera. See further Taieb (2016, 96–100) on the problems with Porphyry's interpretation.

105. Simplicius has a similar view. As he interprets the text, "Aristotle did not mean that the genera were not qualities." Instead, Aristotle thinks that "even if [the] state and condition [of knowledge] are said to be relative, this is not true of all state and condition, but only generic [ἡ γενικὴ μόνον]" (Simplicius *in Cat.* 293,23–25, trans. Fleet). This interpretation also allows us to address another point that leads Frede to doubt the authenticity of 11a.20–38. Frede (1987, 13) complains that 11a.37–8 "contributes nothing to solving the difficulty raised in 11a.20–2." I agree with this judgment, but on my reading the sentence nevertheless has a clear function. Aristotle does not accept that there is a problem with certain terms falling in both the category of quality and the category of relative; he only addresses the problem that "many" (πολλὰ, 11a.21) relatives end up in the category of quality. The function of the sentence at 11a.37–8 is to remind the reader that nothing about the notion of quality or relative requires the two categories to be fully disjoint. Its function is thus to clarify what has, and what has not, been shown in the preceding lines. The fact that it does not directly address the worry voiced at 11a.20–2 thus does not give us any reason to doubt its authenticity, since we can account for its function in a different way. We should not attempt to reconcile it with the preceding passage by construing ποιὸν at 11a.37 as a bearer of some quality rather than a quality: As Frede (1987, 13) argues convincingly, this creates more interpretive problems than it solves.

knowledge, since the considerations that motivate durability and dependency both apply to knowledge as a genus.

There is thus a real, and not merely lexical, tension between the two requirements. On the one hand, Aristotle wishes to pay heed to the fact that we regularly take our knowledge to be stable in a way that it only could be if we did not have to reckon with our knowledge changing on account of factors outside of us. On the other hand, Aristotle takes the grammar of the verb "to know" at face value, as reflective of a metaphysical reality in which knowledge, even in the *statal* sense, is essentially *of* something. His categorial scheme requires that a perishing of the object of knowledge would entail the perishing of any knowledge of it.

Put this way, a solution to the dilemma presents itself. For – and this is the key observation – nothing about the considerations motivating the dependency thesis require Aristotle to say that the object of knowledge ever does actually perish. His remarks about what happens when the object of knowledge perishes may be taken to have the character of a *per impossibile* thought experiment, designed to illustrate how knowledge depends on its object by having us consider the bizarre consequences of a scenario that could never actually occur.

This means that the core claims of *Categories* 7 and 8 regarding knowledge in fact fall shy of a contradiction, although the logical space between them is narrow indeed. Dependency requires only that, *were it possible* for the object of knowledge to perish, knowledge would perish with it. It entails no commitment to the object of knowledge actually being capable of perishing. Seeing this is key to understanding Aristotle's arguments for the necessity of the object of knowledge in *Nicomachean Ethics* VI.3. Let us turn to this now.

## 2.2 When what is changeable goes out of view: *Nicomachean Ethics* VI.3

*Nicomachean Ethics* VI.3 discusses the "states by which the soul speaks the truth in affirmation and denial."[106] Aristotle places knowledge among these[107] and announces his intention to specify what knowledge is, "if one is to be precise about the matter."[108] He starts, however, by discussing the character of "what we know:"[109]

> **T14** (i) We all think that what we know cannot be otherwise. (ii) With what can be otherwise, we do not notice whether it is so or not whenever it goes out of view. (iii) Therefore, the object of knowledge is so of necessity.[110]

This is the only explicit argument for the claim that knowledge is of a necessity to be

106. *Nic. Eth.* VI.3, 1139b.15.

107. The other four are craft (*technē*), practical wisdom (*phrōnesis*), theoretical wisdom (*sophia*) and insight (*nous*).

108. εἰ δεῖ ἀκριβολογεῖσθαι (*Nic. Eth.* VI.3,1139b.18–19).

109. ὅ ἐπιστάμεθα (*Nic. Eth.* VI.3, 1139b.19).

110. πάντες γὰρ ὑπολαμβάνομεν, ὃ ἐπιστάμεθα, μηδ' ἐνδέχεσθαι ἄλλως ἔχειν· τὰ δ' ἐνδεχόμενα ἄλλως, ὅταν ἔξω τοῦ θεωρεῖν γένηται, λανθάνει εἰ ἔστιν ἢ μή. ἐξ ἀνάγκης ἄρα ἐστὶ τὸ ἐπιστητόν, *Nic. Eth.* VI.3, 1139b.19–23. I have numbered the sentences (i), (ii) and (iii) for the sake of exposition.

found in the Aristotelian corpus.[111] Sentence (i) states the conclusion Aristotle intends to establish: "What we know cannot be otherwise." In accordance with my conclusions above, I will take "what we know" to be a state of affairs, and take the use of the uncomplemented copulative verb in application to it to refer to its obtaining, rather than indicating the existence of some substance.[112] As in other passages, Aristotle notes the widespread acceptance of this claim, but whereas elsewhere he seems content to rely on consensus,[113] here he presents an argument,[114] albeit a highly compressed one. Sentence (ii) gives the only explicit premise. In sentence (iii) he proceeds without further ado to draw the conclusion stated in sentence (i), rephrasing it as the claim that what we know "is so of

111. Two other passages parallel the language of *Nic. Eth.* VI.3, 1139b.19–23, but neither of them is arguing for precisely this claim. The first is *Post. An.* I.6, 74b.32–36, but there Aristotle is arguing that the *middle term* of a demonstration that provides *epistēmē* cannot "perish," on pain of the conclusion of the demonstration ceasing to hold. Yet it is the *conclusion* of the demonstration which is the fact known by demonstration, not the middle term. This argument presupposes the claim that what we know is true of necessity and uses it to establish a fact about the imperishability of demonstrative terms; it does not attempt to establish that what we know is a necessity. The other passage is *Met.* Z.15, 1040a.2–5, where Aristotle argues that there are no definitions of individual perceptible substances. Again, he *relies* on the necessity of what we know. His argument is that any attempted definition of an individual perceptible substance would not be necessary, and hence it would not be an object of knowledge, and thus would not really count as a definition. *Met.* Δ.5, 1015b.5–9 contains another argument for the claim that what we know is a necessity, but this argument relies on the strong assumption that what we know is the conclusion of a demonstration from necessary principles. I discuss *Post. An.* I.6, 74b.32–36 and *Met.* Z.15, 1040a.2–5 in this chapter below. *Met.* Δ.5, 1015b.5–9 is the focus of chapter four.

112. A third grammatical possibility would be that it is a predicative ἔστιν with a suppressed complement, so that Aristotle is saying the object of knowledge is necessarily F, for some contextually supplied F. But there is no clear candidate for a suppressed complement in the vicinity. Gauthier and Jolif (1959a, 1:163) supply "*ce qu'il est*." They take Aristotle's claim to be that the object of *epistēmē* is necessarily what-it-is, i.e., necessarily has its essential features. Whereas an object of *epistēmē*, like the triangle of mathematical science, need not *exist* necessarily, they explain, it is necessarily the type of figure that it is. But this seems a lot to read into a simple ἔστιν.

113. See note 23 on p. 3.

114. Note the ἄρα at line 23.

necessity."[115]

Aristotle's argument is at first glance puzzling. Aristotle appears to be relying on the premise that a contingent state of affairs is known only when it is "in view:" Only when it is being actively perceived or attended to. He argues that we *lose* knowledge of "what can be otherwise" when we cease to observe it, implying, on the face of it, that we *do* have knowledge of contingent states of affairs when they are under observation. Yet the conclusion of his argument is that we cannot have any knowledge of what cannot be otherwise to begin with, apparently undermining the supposition that we have that knowledge of a contingent state of affairs when it is "in view."

A parallel passage from the *Topics* brings some clarity here.[116] In *Topics* VI.3, Aristotle writes:

> **T15** for all objects of perception take on an unclear status whenever they go outside perception: It is unclear whether they still obtain, because we are made aware of them only by perception.[117]

Aristotle is describing strategies to be pursued in a dialectical encounter with someone who states something as a "distinguishing feature"[118] of some subject: As a feature that holds of it in all cases and at all times, but without being definitional.[119] One way to refute such an opponent, according to the conventions of dialectic, seems to have been to show that the feature, even if it holds uniquely and at all times, is not "properly given"[120]. For a distinguishing feature to be properly given, it must not only hold at all times, it must be

115. ἐξ ἀνάγκης ἄρα ἐστὶ (*Nic. Eth.* VI.3, 1139b.22–23).

116. The parallel is noted in Reeve (2013, 128) and Gauthier and Jolif (1959b, 2:453). See also *Met.* Z.15, 1040a.2–4.

117. ἅπαν γὰρ τὸ αἰσθητὸν ἔξω γινόμενον τῆς αἰσθήσεως ἄδηλον γίνεται· ἀφανὲς γάρ ἐστιν εἰ ἔτι ὑπάρχει, διὰ τὸ τῇ αἰσθήσει μόνον γνωρίζεσθαι, *Top.* V.3, 131b.21–23.

118. ἴδιον, *Top.* V.1, 128b.14.

119. *Top.* I.5, 102a.18–30.

120. καλῶς ἀποδέδοται, *Top.* V.2, 129b.1.

*evident* from the description used to give it that it does.[121] A distinguishing feature will therefore be improperly given, Aristotle claims, if it requires perception of some further fact in order for it to be evident that it holds at all times.[122] The above is then offered in defence[123] of this claim: No object of perception is properly given as a distinguishing feature of something, since, whenever an object of perception "goes out of perception,"[124] it becomes "unclear"[125] whether it holds. The negative example Aristotle offers is "being the brightest star that goes around the earth" as a putative distinguishing feature of the sun.[126] This is not "well given," Aristotle claims, because when the sun sets, we do not know whether the sun continues to move around the earth, since this is the kind of thing we are aware of "by perception."[127]

The problem with this as a purported distinguishing feature of the sun is not that it fails to hold at all times (not that the sun sometimes fails to move around the earth). The problem is also not that it mentions a *perceptible property* in the sense of a property that the sun may be perceptually verified to have. This is made clear by the example Aristotle gives of what he takes to be an example of well-stated distinguishing property: A distinguishing property of a surface is that it is the primary bearer of color.[128] Being colored is, like travelling around the earth, also a perceptible property. The difference, according to Aristotle, is that it is "clear"[129] that a surface remains colored even when it is unperceived. By contrast, Aristotle thinks that we cannot be sure the sun moves

121. *Top.* V.3, 131a.32–37; cf. *Top.* V.2, 129b.14–16.

122. *Top.* V.3, 131b.19–21.

123. Note the γὰρ at 132b.21 in T15.

124. ἔξω γινόμενον τῆς αἰσθήσεως, *Top.* V.3, 131b.22.

125. ἀφανὲς, *Top.* V.3, 131b.22.

126. *Top.* V.3, 131b.25–26.

127. τῇ αἰσθήσει γνωρίζεται, *Top.* V.3, 131b.27.

128. ὃ πρῶτον κέχρωσται, *Top.* V.3, 131b.35.

129. φανερόν, *Top.* V.3, 131b.35.

around the earth when it sets, because we would need to observe it to verify that it is still moving.[130]

Aristotle's discussion of well-stated properties in *Topics* V thus makes use of a distinction between perceptual awareness (what we have when we are actively checking that the sun moves around the earth) and something being "clear" in a way that does not require perceptual verification. In order to understand Aristotle's argument in T14, we must distinguish carefully between what he is saying about knowledge proper, on the one hand, and this type of perceptual awareness on the other.

Aristotle is arguing that we cannot have *knowledge* of what can be otherwise. He argues this, however, by means of a consideration about perceptual awareness. We *can* have perceptual awareness of a contingent state of affairs when we are observing it. However, we are liable to lose our awareness that a contingent state of affairs holds when we cease to observe it. This is because perceptual awareness, like knowledge, is a relative in the sense of *Categories* 7. A mental state only counts as awareness of some state of affairs so long as its object, the state of affairs that is its correlative, continues to hold. And so, if one is not actively attending to it (if it is not "in view"), it is possible that the state of affairs will cease to hold without the knower noticing.[131] If one does not immediately update one's beliefs, replacing the old, expired belief with a new belief that accurately reflects the changed state of affairs, one goes from a state of having awareness of that state of affairs to a state of ignorance.

This observation about perceptual awareness bears on scientific knowledge in the following way. Aristotle is assuming that having awareness of a state of affairs is a necessary, but not sufficient, condition for having knowledge of it. It follows that in any circumstance

130. The reason, presumably, is that the sun would not cease to be the sun if it were to stop moving, whereas a surface could not, presumably, be a surface without bearing color (cf. *Met.* Δ.18, 1022a.14–19, *Met.* Z.15, 1040a.31–32).

131. Cf. also *Pr. An.* II.21, 67a.39–67b.1.

in which we have knowledge, we must also have awareness (but the converse does not hold). Aristotle now has us consider what would follow if someone had knowledge of some fact that could cease to hold, e.g., that Socrates was sitting. Someone has awareness of this fact when observing Socrates, but, because this awareness is a relative and thus dependent on the state of affairs it is of, one may lose such knowledge simply because Socrates gets up and they were not paying attention.[132] Since knowledge requires awareness, that means that one could go from having knowledge to not having it, merely on account of the fact that Socrates got up and one failed to notice, if this were a possible object of knowledge. Yet this possibility is incompatible with the durability of knowledge, which requires that only an illness or some such thing ever cause one to lose the knowledge one has: However we settle the precise boundaries of what counts as something like "an illness," Socrates getting up is not going to count.

The problem, then, is that the dependency thesis implies knowledge of contingencies will, on Aristotle's account, in a specific sense be *unstable*. It will be unstable in the sense that one and the same mental state could fluctuate between counting as a state of knowledge and failing to count as a state of knowledge, simply because of an external change in the state of affairs known. For knowledge in the sense of perceptual awareness, Aristotle sees no paradox in the possibility of this type of fluctuation. On his view, we simply *do* go from having awareness of a fact like Socrates's being seated to not having it when Socrates gets up, unless we update our beliefs accordingly.[133] But Aristotle denies that *scientific knowledge* (*epistēmē* in the sense under discussion in *NE* VI.3) could be unstable in this way. This is the durability thesis we extracted from *Categories* 8: Knowledge may not cease to be knowledge simply on account of a change of its object. As Aristotle puts it in *Metaphysics* Z.15:

132. Cf. *Cat.* 5, 4a.23–26.

133. That is, unless we go from believing that Socrates is sitting to believing that he is standing. Cf. *Cat.* 5, 4a.23–28 and *De An.* III.3, 428b.4–9.

**T16** Knowledge cannot sometimes be knowledge and sometimes be ignorance[134]

Aristotle mentions by way of contrast that belief might fluctuate in this way,[135] whereas he holds it to be a feature of knowledge that it cannot be subject to such fluctuations. Scientific knowledge must be "steady" in the sense that one and the same *internally* identical mental state may not at one time count, and at another time fail to count, as a state of knowledge. That is, if there are certain non-relational features of my psyche that are at $t_1$ sufficient for me counting as having knowledge, then there cannot be some future times where these are still sufficient and others when they fail to be (when they merely constitute "ignorance"). And yet, according to the claim made in sentence (ii) of T14, this is precisely what would happen if the object of knowledge were something "contingent" in the sense of being changeable in truth-value. One and the same mental state might go between counting as knowledge and failing to count as knowledge. It would fluctuate in this way not on account of some harm repeatedly incapacitating the knower, but simply on account of the object of one's knowledge no longer holding, making it the case that there was no longer anything for that person's knowledge to be "of."[136] Aristotle takes that to be incompatible with the durability of knowledge, and so rejects the claim that knowledge could have a contingent object.

Aristotle's argument may thus be represented as follows:

(1) Everything that can be otherwise is such that we are assured that it holds only when we perceive it,

(2) (but no object of scientific knowledge is such that we are assured that it holds only when we perceive it)

(3) Therefore, no object of scientific knowledge can be otherwise.

134. οὐδ' ἐπιστήμην ὁτὲ μὲν ἐπιστήμην ὁτὲ δ' ἄγνοιαν εἶναι, *Met.* Z.15, 1039b.32–33.

135. *Met.* Z.15, 1039b.34–35.

136. Cf. *Cat.* 7, 7b.29–30 (T7).

Aristotle endorses (1) on the basis of the dependency thesis and (2) on the basis of the durability claim. Both the idea that knowledge is stable from *Categories* 8 and the idea that it is dependent from *Categories* 7 are thus necessary to secure Aristotle's conclusion.[137] Because scientific knowledge is a relative, it depends on the holding of its correlative, the object of scientific knowledge. The status of scientific knowledge as a relative thus explains why, if the object of knowledge is a state of affairs that may cease to hold, we are liable to lose this knowledge when what we know goes "out of view." It does not, however, explain why this result is unacceptable, and hence it also does not explain why Aristotle takes himself to be warranted in rejecting the premise that there could be a perishable object of knowledge. It only seems to show that knowledge of perishables would require a sort of *rational updating*: Knowledge of contingencies would simply require that we are poised to register the fact that something we previously knew no longer obtains, and subsequently to adopt the correct attitude, that it does not.

It is the fact that scientific knowledge is *durable* that rules this out as a possibility. Here it is important, as the context of T14 makes clear, that Aristotle is talking about knowledge as a state or *hexis* connected with the exercise of intellectual virtues. The state of knowledge in this sense is not the sort of thing that can come and go simply because no "rational updating" takes place. Losing it or acquiring it requires a destructive change to the intrinsic makeup of the cognitive faculty of the knower. The fact that we might, with a contingent state of affairs, rationally update our knowledge in accordance with changes in

137. Bolton (2012, 53) has likewise emphasized the importance of the idea that knowledge is stable articulated in *Categories* 8 for interpreting the argument in T8. I find myself deeply in agreement with many of his claims, and much of this paper may be viewed as an elaboration on them. Yet it bears emphasizing that if we try to read this passage as depending *solely* on the durability principle, then the argument is bound to seem fallacious: For it is hard to see why Aristotle should take himself to be licensed to infer from the fact that the mental state of *epistēmē* is especially stable to the conclusion that its object is maximally stable. Aristotle's remark will at best seem like a vague argument from analogy. It is only by supplying premise (2), which depends on the idea that knowledge is a relative articulated in *Categories* 7, that we are able to obtain a clear view of Aristotle's reasoning.

its object turns out therefore to be neither here nor there. A contradiction can be generated merely by considering the case in which we *fail* to update our scientific knowledge in accord with the changes in the object. In this case, the durability principle requires that we still have scientific knowledge of it, since this failure to rationally update does not constitute the type of change that may cause us to lose scientific knowledge, and yet the dependency thesis implies that we cease to know when the relevant state of affairs no longer holds. Aristotle, accordingly, rejects the premise that we can have scientific knowledge of anything "contingent" or "perishable:" Any possible object of knowledge remains as we take it to be eternally, and in this sense is necessary.[138]

### *2.2.1 The sense of "necessity"*

It bears emphasizing that this argument does not, and does not purport to, establish anything about the essential or inessential character of truths we know. Instead, as we have seen, it only shows that a contradiction would result from positing that a state of affairs known might *cease to hold*. Aristotle thus concludes that the objects of knowledge are not such as to ever cease to be true; they are in this sense eternal. But this does not immediately imply anything about whether these truths are "necessary" in any other sense.

There is some evidence that Aristotle only takes his durability arguments to establish the necessity of what we know in this sense of being eternally true. Consider again how he goes on immediately after offering the central argument of *Nicomachean Ethics* VI.3. After concluding that "the knowable is of necessity" (1139b.22), he says:

> **T17** Therefore it is eternal: For everything that exists of necessity without qualification is eternal, and what is eternal is neither generable nor destructible.[139]

138. See *Nic. Eth.* VI.3, 1139b.23–24.

139. ἀίδιον ἄρα· τὰ γὰρ ἐξ ἀνάγκης ὄντα ἁπλῶς πάντα ἀίδια, τὰ δ' ἀίδια ἀγένητα καὶ ἄφθαρτα, *Nic. Eth.* VI.3, 1139b.23–24.

These consequences of the necessity of the object of knowledge – that it is eternal, ingenerable and incorruptible – do not serve as premises in any argument that Aristotle goes on to give in this chapter. Aristotle states them, rather, in elaborating what it means for knowledge to be "necessary" in the sense at issue here. Aristotle is clarifying that the objects of knowledge are "necessary" in the *sense* that entails eternal truth, i.e., truth that cannot come to be or perish. This is further supported by his use of the phrase "necessity without qualification." Necessity "without qualification"[140] is the type of necessity that Aristotle discusses in *Generation and Corruption* II.11. Of this type of necessity he says:

> **T18** "Always" and "of necessity" coincide: For what is necessary cannot not be, so that if something is of necessity, it is eternal, and if it is eternal, it is of necessity.[141]

Thus, Aristotle takes necessity "without qualification" to be equivalent to eternal truth. This is one important sense in which knowledge is of a necessity, and it is the sense of "necessity" in which knowledge is of necessities established by the durability arguments. But, as we will see in the next chapter, Aristotle also takes knowledge to be necessary in an essentialist sense. I examine this in the next chapter.

### *2.2.2 A Platonic precursor:* Theaetetus *163c–164b*

We have seen that Aristotle's argument for the necessity of knowledge relies on a sharp distinction between *knowledge*, which was taken to be durable, and *perceptual awareness*, which is taken to regularly fluctuate in its truth. This way of thinking about the distinction of knowledge and perceptual awareness has precedent in Plato's *Theaetetus*, which presents an argument with a similar structure to this one. In that dialogue, Socrates and Theaetetus

140. ἁπλῶς, 337b.10, 31, 338a.4, 15.

141. τὸ γὰρ ἐξ ἀνάγκης καὶ ἀεὶ ἅμα· ὃ γὰρ εἶναι ἀνάγκη οὐχ οἷόν τε μὴ εἶναι· ὥστ' εἰ ἔστιν ἐξ ἀνάγκης, ἀίδιόν ἐστι, καὶ εἰ ἀίδιον, ἐξ ἀνάγκης, *Gen. et Cor.* II.11, 337b.35–338a.2.

consider three candidates for what knowledge (*epistēmē*) could be: (1) Perception, (2) true belief, and (3) true belief with an account. The first sustained challenge to the claim that knowledge is perception comes at *Theaetetus* 163c–d.

> SOCRATES. Excellent, Theaetetus. [...] But look, here's another objection coming up. See how we can fend it off.
>
> THEAETETUS. What sort of objection?
>
> SOCRATES. It goes like this. Suppose someone asked: 'If someone has come to have knowledge of something at some time, and he still has a memory of that very thing and is unharmed, is it possible that, at the very time when he remembers it, he might fail to know the very thing which he remembers?' I seem to be taking a long time to say it; what I mean to ask is whether someone who has come to know something and remembers it might not know it.
>
> THEAETETUS. How could he, Socrates? What you're describing would be monstrous.[142]

Socrates and Theaetetus agree that it would be an unacceptable conclusion that someone might come to know something, not forget it, and nevertheless cease to know it. This will be used as the central premise in a *reductio* against the claim that knowledge is perception.

In taking this conclusion to be "monstrous," Socrates is putting forward his own version of the durability condition. Like Aristotle, he holds that there is some class of possible events absent which someone does not go from knowing to not knowing. Further, both characterize this class of events in terms of mishaps that the knower might experience: For Aristotle, illness or "some such thing," for Plato, forgetting. Aristotle and Socrates

142. *Theaetetus* 163c.3–d.6. The key lines at 163d.1–4 read: ἆρα δυνατὸν ὅτου τις ἐπιστήμων γένοιτό ποτε, ἔτι ἔχοντα μνήμην αὐτοῦ τούτου καὶ σῳζόμενον, τότε ὅτε μέμνηται μὴ ἐπίστασθαι αὐτὸ τοῦτο ὃ μέμνηται;

at this point in the dialogue therefore agree that knowledge does not fail on account of some change in the object of knowledge: Someone ceases to have knowledge only when something goes wrong on the side of the knower.

The dialogue goes on:

> SOCRATES. What about this: you say there's such a thing as memory, don't you?
>
> THEAETETUS. Yes.
>
> SOCRATES. Of nothing, or of something?
>
> THEAETETUS. Of something, naturally.
>
> SOCRATES. Of things one has come to know and things one has perceived– that sort of thing?
>
> THEAETETUS. Of course.
>
> SOCRATES. Then one sometimes remembers something one has seen?
>
> THEAETETUS. Yes.
>
> SOCRATES. Even when one has shut one's eyes? Or does one forget when one does that?
>
> THEAETETUS. It would be strange to say that, Socrates.
>
> SOCRATES. Yes, but we have to, if we're going to save what we said before; otherwise it goes by the board.[143]

Socrates, again like Aristotle, now considers what happens when the knower ceases to "keep an eye" on the object of knowledge. When we cease to look at something, we cease to perceive it. If perception is knowledge, that means we thereby cease to know it. We do

143. *Theaetetus* 163e.4–13.

not, just by closing our eyes, cease to remember it, however. If we suppose further that we know whatever we remember, then we have a contradiction: When we close our eyes and cease to perceive some fact, we both (i) know it, because we remember it, and (ii) fail to know it, because we are not then perceiving it.[144]

Socrates and Theaetetus conclude that knowledge cannot be perception:

> SOCRATES. So it looks as if one gets an impossible result if one says knowledge and perception are the same.
>
> THEAETETUS. Apparently.
>
> SOCRATES. So we must say knowledge is one thing and perception another.
>
> THEAETETUS. It looks as if we must.[145]

Like Aristotle's argument examined above, this argument turns on the assumption that knowledge must be durable. This is not stated directly, but instead in terms of the existence of memory. To say that "we have memory," and to affirm that memory is "of something" is to say that we have a capacity to retain knowledge in the normal course of events – we do not cease to have knowledge suddenly or out of the blue. Memory is thus thought of as a capacity we have for retaining knowledge, such that we do not cease to have knowledge unless this capacity fails. Perception, by contrast, is ephemeral: We cease to have perception as soon as we close our eyes. It is this mismatch between the stability of knowledge afforded by memory and the transitory character of perception that allows the "monstrous conclusion" to be drawn, and hence provides a challenge to perception's claim to be knowledge.

144. This agrees with the interpretation of McDowell (2014, 124). In general commentators pass over this argument very quickly; Conford (1957), Bostock (1988) and Burnyeat (1990) are all but silent on it.

145. *Theaetetus* 164b.8–12.

Aristotle presupposes a distinction between knowledge and perceptual awareness along the same lines in the argument examined above. Knowledge must be stable in its truth, where perceptual awareness need not be. Given the further premise that knowledge is a *relative*, Aristotle infers that the object of knowledge must also be different from the object of perception. Thus, the durability of knowledge implies not only a distinction between the faculties of knowledge and perception, as is argued in *Theaetetus* 163c–164b. The objects of these faculties also must be at least as stable as the faculties thesmelves, given that they are relatives. No special conclusion may be inferred regarding the objects of perception, given that it is lost when we close our eyes. But since knowledge is generally retained over time, its object must be something that we can be sure retains its truth even when we are not looking. The most natural candidate for this is something that *never* changes its truth and is in this sense a necessity.

## 2.3 Durability and demonstration: *Posterior Analytics* I.6

In *Posterior Analytics* I.6, Aristotle gives an argument that resembles the language of *Theaetetus* 163c–164b even more closely:

> **T19** Again, if someone does not know something now, although he possesses the account and is unharmed, and the object is preserved, and he has not forgotten, then he did not know it earlier either.[146]

Aristotle gives a set of individually necessary and jointly sufficient conditions for someone to continue to know something: That they (i) continue to possess an "account" of what they know, (ii) they remain unharmed, (iii) the "thing" they know remains the same, and (iv) they do not forget it. If all of these things continue to hold, then someone cannot fail to still know something they once knew. Should a person be found not to have knowledge

146. ἔτι εἴ τις μὴ οἶδε νῦν ἔχων τὸν λόγον καὶ σῳζόμενος, σῳζομένου τοῦ πράγματος, μὴ ἐπιλελησμένος, οὐδὲ πρότερον ἤδει, *Post. An.* I.6, 74b.32–34.

despite all these conditions holding, it must be that they did not really know the thing to begin with.[147]

There are three notable affinites between this argument and *Theaetetus* 163c–d. First, the talk of being "unharmed"[148] is noteworthy – in Aristotle, it seldom occurs in this sort of context,[149] and we find the same verb, also occurring as a participle, occupying a prominent position in the core of the *Theaetetus* argument at 163d, where Socrates uses the same verb to describe someone coming to no harm over a period of time.[150]

Second, the roundabout way Aristotle puts his point recalls the circumlocution in his way of putting things that Socrates calls attention to at 163c ("I seem to be taking a long time to say it, but..."). Aristotle's might have said simply that someone retains knowledge so long as they possess the account, remain alive, remain unharmed, do not forget and the thing they knew remains as they took it to be. Instead he makes his point more circuitously, by saying that if someone who purportedly knows something at some given point of time continues to satisfy these conditions and yet is found at a later time *not* to know it, then he did not in fact know it to begin with.

Third, Aristotle, like Socrates at *Theatetus* 163d, explicitly invokes memory here as a condition for the retention of knowledge. The *only* way to lose knowledge, when the knower and the object are preserved, is to forget. This is made more explicit in a passage in the *Topics*:

147. *Post. An.* I.6, 74b.34.

148. σῳζόμενος, *Post. An.* I.6, 74b.32.

149. This chapter contains the only occurrences of these verbs in the *Prior* and *Posterior Analytics*.

150. σῳζόμενον, *Theaetetus* 163d.3.

**T20** e.g. in the case of forgetfulness and having forgotten; for people refuse to admit that the man who has lost his knowledge of a thing has forgotten it, because if the thing alters, he has lost knowledge of it, but he has not forgotten it. Accordingly the thing to do is to withdraw the part objected to, and assert the remainder, e.g. that if a person has lost knowledge of a thing while it still remains, he then has forgotten it.[151]

Aristotle is here illustrating a dialectical principle, rather than arguing a philosophical point: He is explaining how one may, in the face of an objection, retreat to a weaker version of one's thesis. But in the course of doing so he makes explicit the connection he sees between knowledge loss and memory. He considers, and grants, an objection to the general thesis that we cannot lose knowledge without forgetting: We *can* lose knowledge without forgetting if the object changes, even if we do not suffer a loss of memory. He thus recommends endorsing the weaker principle that we cannot lose knowledge without forgetting *so long as* the object in question remains the same. If we take Aristotle to be leaving aside cases where the person is harmed or the account itself is no longer possessed, then this accords with the principle spelled out in *Posterior Analytics* I.6. This may be clearer if we reformulate it as follows:

> Assuming the knower and the knower's account are not changed, then, if the object of knowledge remains the same, the *only* way to lose knowledge is to forget.

Aristotle's claim at T19 may thus be viewed as a refinement on the principle put forward at *Theaetetus* 163d.1–4. Memory and being unharmed are not on their own sufficient for knowledge retention, but they are jointly sufficient given also the preservation of the object, and the "account" of what is known.

151. οἷον ἐπὶ τῆς λήθης καὶ τοῦ ἐπι λελῆσθαι· οὐ γὰρ συγχωροῦσι τὸν ἀποβεβληκότα ἐπιστήμην ἐπιλελῆσθαι, διότι μεταπεσόντος τοῦ πράγματος ἀποβέβληκε μὲν τὴν ἐπιστήμην, ἐπιλέλησται δ' οὔ. ῥητέον οὖν, ἀφελόντα ἐν ᾧ ἡ ἔνστασις, τὸ λοιπόν, οἷον εἰ διαμένοντος τοῦ πράγματος ἀποβέβληκε τὴν ἐπιστήμην, ὅτι ἐπιλέλησται, *Top.* VIII.2, 157b.11–16.

In the broader context of the chapter, Aristotle's point in adumbrating these criteria for knowledge retention in *Posterior Analytics* I.6 is not to argue that the object of knowledge must be a necessity. Aristotle takes that for granted from the beginning of his discussion of knowledge in the *Posterior Analytics*, and the argument we have examined helps show why: Aristotle takes knowledge to be of necessities in order to reconcile the dependency of knowledge with its durability. In T19, Aristotle is considering the consequences of the idea introduced in *Posterior Analytics* I.2, that there is a type of knowledge that is had by grasping a syllogism whose conclusion is the thing we know. Aristotle defines a "demonstration"[152] as this type of argument. If knowledge is of necessities, and what we know is the conclusion of a demonstration, it follows that the conclusion of such an argument must be true of necessity.

In *Post. An.* I.6, Aristotle is considering what we may infer regarding the character of the *premises* of such an argument rather than its conclusion. In particular, he is arguing that the premises of such an argument must also be true of necessity.[153] Since this does not follow as a matter of logic,[154] Aristotle must provide a further argument in order to show that the premises of a demonstration must also be necessary.

The principle given in T19 is the first premise in an argument to show this. It spells out what it means for there to be knowledge by grasp of an argument. What this means, more specifically, is that grasping this type of argument must be *sufficient* for retaining knowledge of its conclusion, so long as the knower (i) remembers, (ii) is unharmed and (iii) what they know is unchanged. Condition (iii) is, however, redundant given that the conclusion of such an argument is a necessity; hence the condition comes to (i) and (ii). Aristotle goes on to explain why this assumption shows that the premises of a demonstrative syllogism

152. ἀπόδειξιν, *Post. An.* I.2, 71b.16–17.

153. *Post. An.* I.6, 74b.10–11, 15, 18. Cf. Ross (1949, 526), Burnyeat (1981, 111), Sorabji (1981, 238n).

154. *Post. An.* I.6, 75a.1–4.

must be necessary truths:

> **T21** the middle might perish, if it were not necessary, and so the person would retain the account, be preserved, and the thing be preserved, but not know. But then it follows that the person did not initially have knowledge.[155]

Aristotle claims that, if the premises of a demonstration were not necessary, they would be capable of transitioning in truth-value. This is what he describes as the "middle term" of a demonstration "perishing." Aristotle is here thinking of the middle term of a demonstration as the fact of the two premises being jointly true, thus constituting a logical "link" between the major and the minor term that is expressed in the conclusion. So, for instance, in the argument that Socrates is human because Socrates is sitting down beside me and what is sitting down beside me is human, the middle term, "sitting down beside me," could "perish" in the sense that "sitting down beside me" ceases to be something that connects Socrates and being human. In this way the words "Socrates is sitting beside me and what is sitting beside me is human" would cease to be true, and thus cease to constitute a sound argument for Socrates being human. But Aristotle assumes that a demonstration will, at a minimum, need to be a *sound* deduction.[156] It follows that, if the middle term could "perish" in the manner imagined here, an account which was at one time a demonstration could cease to constitute a demonstration, an argument the possession of which provides knowledge.

Aristotle is assuming here that the possession of a demonstration is also a *necessary* condition for knowing its conclusion,[157] so that at any time we *lack* a demonstration, we do not know it. It follows that if the premises of a demonstration were not necessary in the

155. φθαρείη δ' ἂν τὸ μέσον, εἰ μὴ ἀναγκαῖον, ὥστε ἕξει μὲν τὸν λόγον σῳζόμενος σῳζομένου τοῦ πράγματος, οὐκ οἶδε δέ. οὐδ' ἄρα πρότερον ᾔδει, *Post. An.* I.6, 74b.34–36.

156. *Post. An.* I.2, 71b.25.

157. We should not "dilute" this to the condition that someone possesses a reason of some sort or other, as Barnes (1993, 127) claims we must.

sense of remaining stably true, someone *could* go from knowing something to not knowing it, without a failure in memory, coming to any harm, or the object of their knowledge changing. But that would contradict the four conditions on the retention of knowledge that Aristotle has just articulated, viz. that we retain knowledge so long as we and the object remain intact, and we continue to possess the account and our memory of what we know remains.

Take the example demonstration above. If the argument from the premises that Socrates is sitting next to me and what is sitting next to me is human were a demonstration that Socrates is human, then, if Socrates should cease to be sitting next to me, this would cease to be a sound argument and hence also cease to be a demonstration. And yet it would not need to be the case that I had forgotten that Socrates is human, let alone for me to have been severely harmed. Nor has the thing that I know – that Socrates is human – ceased to be true. Nor even have I ceased to retain this account: I still am able to offer the same words that I was before as an explanation for Socrates being human. The problem is that these no longer *count* as a demonstration, because the states of affairs the premises describe have themselves changed. Under the assumption that possession of the relevant demonstration is necessary for knowledge of each demonstrable fact, it follows that we could cease to have knowledge of the fact that Socrates is human without anything going wrong with us, nor with any change in the truth-value of that fact.

Aristotle clarifies that it is not whether such a change actually takes place that matters for his argument, but that it *could*:

> **T22** And if [the middle term] does not perish, but it is capable of having perished, what we have described will be capable of occurring, yet it is impossible to have knowledge under these conditions.[158]

158. εἰ δὲ μὴ ἔφθαρται, ἐνδέχεται δὲ φθαρῆναι, τὸ συμβαῖνον ἂν εἴη δυνατὸν καὶ ἐνδεχόμενον. ἀλλ' ἔστιν ἀδύνατον οὕτως ἔχοντα εἰδέναι, *Post. An.* I.6, 74b.36–39.

Aristotle is here foreclosing the possibility that there could still be demonstrations with contingent premises, but that these would merely cease to be demonstrations *at those times when the premises ceased to be true* and be demonstrations at other times. Instead, what it means for a demonstration to be sufficient for retaining knowledge is that the retention of the corresponding account *guarantees* the retention of knowledge, given no failures of memory and no harm done to the person. It thus follows that the very possibility of a demonstration ceasing to be such means that it cannot serve as a demonstration even at those times when its premises are true. A demonstration must *reliably* secure knowledge in the sense that someone with a demonstration is in secure possession of what they know,[159] that their knowledge is not liable to be lost on account of their knowledge-producing account ceasing to hold. As Aristotle puts it:

> **T23** just as knowledge cannot be knowledge at one time and ignorance at another, such a state being belief and not knowledge, so also demonstration and definition cannot be demonstration and definition at one time but not at another[160]

The reason why a demonstration could not sometimes be a demonstration and sometimes not is that knowledge is durable in the sense we encountered in *Categories* 8. Under the assumption that possessing a knowledge-producing account[161] is a necessary condition for having knowledge, it follows that these accounts themselves cannot fluctuate between being such and not being such. Knowledge-producing accounts inherit the durability property from knowledge itself.

Implicit here is the idea that we encountered above, that an assertoric sentence, like a piece of knowledge or a belief, *depends* for its truth on the ongoing obtaining of the

159. Compare *Meno* 97b.–98a. The connection is explored at length in Ferejohn (2013).

160. ὥσπερ οὐδ' ἐπιστήμην ὁτὲ μὲν ἐπιστήμην ὁτὲ δ' ἄγνοιαν εἶναι, ἀλλὰ δόξα τὸ τοιοῦτόν ἐστιν, οὕτως οὐδ' ἀπόδειξιν οὐδ' ὁρισμόν, *Met.* Z.15, 1039b.32–34.

161. Aristotle here includes definitions as well as demonstrations

state of affairs it asserts. That is why contingent premises could cease to be true, and hence why the same account could cease to be a demonstration. Since the statement that Socrates is sitting depends on Socrates staying seated for it to continue to count as a true sentence, a demonstration with contingent premises would rely on the continued obtaining of the premises for it to continue to constitute a demonstration. But since the possibility of it ceasing to count as a demonstration is incompatible with the retention of the account being sufficient for retaining knowledge under normal conditions, it follows that not only the conclusion, but also the premises of a demonstration must be necessities.

## 2.4 Knowledge of sensible particulars: *Metaphysics* Z.15

The idea that there are certain arguments that reliably provide knowledge is leveraged by Aristotle into an argument for a more radical conclusion regarding the object of knowledge in *Metaphysics* Z.15. Aristotle argues there that *particulars* cannot be the subjects of demonstration or definition.[162] He will employ this as the linchpin in an argument against the possibility of defining Platonic Forms by making use of the premise that "a Form is a particular."[163] I discuss this argument in the next chapter.[164] In the process of making this argument, however, Aristotle first argues that there cannot be knowledge of *perishable* particulars, using an argument similar to those we have been examining:

> **T24** Perishable things become unclear to the person possessing knowledge whenever they go out of perception, and, although the account of them is preserved in the soul, it will not be a demonstration or a definition.[165]

162. οὔτε ὁρισμὸς, *Met.* Z.15, 1039b.28.

163. τῶν γὰρ καθ' ἕκαστον ἡ ἰδέα, *Met.* Z.15, 1040a.8–9.

164. See section 3.2.

165. ἄδηλά τε γὰρ τὰ φθειρόμενα τοῖς ἔχουσι τὴν ἐπιστήμην, ὅταν ἐκ τῆς αἰσθήσεως ἀπέλθῃ, καὶ σωζομένων τῶν λόγων ἐν τῇ ψυχῇ τῶν αὐτῶν οὐκ ἔσται οὔτε ὁρισμὸς ἔτι οὔτε ἀπόδειξις, *Met.* Z.15, 1040a.2–1040a.5.

While this argument resembles the argument in *Nicomachean Ethics* VI.3 (T14) in its language and overt structure, it is important to see that it differs both in its conclusion and its argumentation. In T14, Aristotle argued that only facts that are "necessary" in the sense that could not change in their truth value could be items of knowledge. Here Aristotle is arguing that there cannot be knowledge of a fact that has as its subject a term for a perishable individual. No fact of the form "Socrates is F," that is, could be an item of knowledge, because Socrates is a perishable individual. The two claims are not obviously equivalent: We may think that there could be necessary facts about Socrates, or that there could be contingent predications whose subject term was not the name of a perishable individual (everything white is moving, for instance).

The conclusion Aristotle is arguing for here is not the same as the one established in T14, then. The argumentation is also different. Aristotle does, as in T14, suppose for reductio that we could know a fact of the offending type (here: a fact of the form $S$ is $P$, where $S$ is a term for a perishable individual), and furthermore like in T14 he considers the possible consequences of someone ceasing to attend to this fact in perception. But the counterfactual consequence drawn in this argument is different. Instead of inferring directly that we would not know the fact in question if the individual perished, Aristotle in T24 argues that we would cease to have a *demonstration* or a *definition* of it, even if the account was "preserved in the soul." In other words, his claim is that if $S$ is a term that names a perishable individual, then, if we cease to perceive that $S$ is $P$, it is possible that a demonstration that $S$ is $P$ will cease to be a demonstration that $S$ is $P$, or a definition with the content that $S$ is $P$ will cease to be a definition with that content.

The idea is the same one that we encountered above in the context of T21: A demonstration must be a sound argument, and hence must have a true conclusion. Therefore, if a proposition could go from being true to being false, a demonstration of it could go from being a demonstration to not being one. Likewise, a definition must be a true state-

ment. Therefore, a definition of something which could cease to be true could cease to be a demonstration. But Aristotle infers that if $S$ should perish, then the fact that $S$ is $P$ will cease to be true, for any $P$. And hence any demonstration with this conclusion or definition with this content would be capable of ceasing to be a demonstration or definition. This, however, offends against the principle articulated in T23: It cannot be the case that a demonstration or a definition at one time counts as one and at another time doesn't.

The argument structure here is thus a more convoluted variant on T14, taking a detour through the concept of demonstration or definition. Any demonstration or definition concerning a perishable individual would cease to be a demonstration or definition if that individual perished:

1. Any demonstration (definition) about a perishable individual has the property that it could cease to be a demonstration (definition) because the individual perishes,
2. But no demonstration (definition) has the property that it could cease to be a demonstration (definition) because the individual perishes,
3. Therefore, no fact about a perishable individual is an object of demonstration or definition.

Assuming the necessity of demonstration or definition for knowledge, it follows that no fact about a perishable individual is an object of knowledge.

## 2.5 Taking stock

Let us now step back and consider what is, and is not, established by these arguments. *Metaphysics* Z.15, *Posterior Analytics* I.6 and *Nicomachean Ethics* VI.3 each present structurally similar, but substantively distinct arguments. *Nicomachean Ethics* VI.3 argues that the object of knowledge inherits the stability of knowledge as a mental state, and hence must hold of necessity. In *Posterior Analytics* I.6, Aristotle works from the assumption

that anything known is known in virtue of possessing a demonstrative syllogism, and argues that this syllogism must have necessarily true premises so as not to contravene the durability of knowledge. *Metaphysics* Z.15 assumes that whatever is known is known in virtue of grasping a demonstrative or definititional account, and argues that there could be no such account, and therefore no such knowledge, of a fact about a perishable individual.

The conclusions of these arguments are less disconcerting when we see that Aristotle's claims apply to knowledge as a *state*, and that he recognizes other senses of "knowledge." I have discussed two of these other senses in this chapter. First, Aristotle recognizes a type of perceptual awareness of particulars, but he does not consider it knowledge in the strict sense. Second, Aristotle thinks of knowledge as a state that is "used," "exercised" or "employed."[166] In addition to the abiding state, the term "knowledge" may denote the occurrent exercise of such a state being employed to explain features of particulars encountered in experience. Thus, Aristotle's position is not that knowledge in no way consorts with the contingent and perishable, but that these belong to the exercise of knowledge rather than its content as an abiding state. This is still a surprising philosophical claim, but no longer one that has the appearance of skepticism or absurdity.

Nevertheless, we may worry at this stage that Aristotle's position still rules out study of the empirical world in any robust sense. In particular, Aristotle's position as I have presented it so far may seem to make Aristotle worryingly close to the tradition that I claimed in the Introduction he reacts against: The tradition that sees the proper locus of our epistemic endeavours as residing in a handful of pure disciplines. In the next chapter, I will explore how Aristotle positions himself explicitly with respect to those who infer on the basis of similar considerations that there must be Forms, and how he is able to finesse the conclusions of the arguments established in this chapter in order to leave room for the study of the empirical world.

166. See p. 55.

# CHAPTER 3

# THE OBJECT OF KNOWLEDGE

In the previous chapter, I reconstructed Aristotle's arguments for the claim that the object of knowledge is a necessity, and kindred arguments that the premises of demonstrations must be necessities and that the object of knowledge cannot be a fact about a perishable individual. I argued that these may be viewed as the outcome of an attempt to reconcile the stability of our knowledge with the idea that knowledge is vulnerable to changes in its object.

As I pointed out in the Introduction,[1] Aristotle is not the first philosopher to divide knowledge and belief by their objects. We may add that he is also not the first to take there to be an incongruity in the idea of a stable mental state that has as its object something unstable. On certain interpretations, this argumentative strategy is pursued implicitly by Heraclitus[2] and Parmenides,[3] and it is made explicit in Plato. The *Timaeus* introduces the Forms as objects of knowledge, as things that are "not perceptible by us, but are rather

1. See pp. 4–5 in section 1.1.

2. On certain readings, Hercaleitus also takes there to be a problem concerning the possibility of stable knowledge of things subject to change (or "flow"). On this reading, he appeals to the notion of "*logos*," understood as meaning "ratio," "measure" or "cosmic law," to provide a fixed point throughout flux. The stability of the *logos* in contrast with all that flows is what makes it, on this reading, "the stable proper object of knowledge in a world of perpetual change." See Johnstone (2014, 9) and the references therein.

3. See especially the interpretation of White (2005, 13), who takes Parmenides to be principally concerned with the type of "stability" and "trustworthiness" the world must have for our knowledge of the world to have "enduring reliability."

knowable only."[4] In the same passage, they are characterized as "the most stable things."[5] The existence of these "most stable" things, the Forms, is inferred from the premise that knowledge, unlike belief and perception, is "unshakable" in the sense that someone with knowledge cannot be rationally persuaded out of what they know.[6] Plato's argument at *Timaeus* 51D thus moves from the premise that knowledge is in a certain sense stable ("unshakable")[7] to the conclusion that knowledge therefore must have a supremely stable

4. ἀναίσθητα ὑφ' ἡμῶν εἴδη, νοούμενα μόνον, *Timaeus* 51d.5.

5. βεβαιότατα, *Timaeus* 51d.7. The characterization is indirect: It is remarked that if knowledge were no different than true seeming, then the objects of true seeming or perception would be "the most stable things." They would be the most stable things because it is taken for granted that the objects of knowledge are supremely stable, and so, if true seeming *were* knowledge then the objects of true seeming would be the objects of knowledge, and hence the most stable things (a conclusion supposedly meant to be absurd, and hence to support rejecting the antecedent of the conditional, that knowledge is no different from true seeming).

6. ἀκίνητον πειθοῖ, *Timaeus* 51e.4. This is not the sense of "stability" that Aristotle's durability argument turns on, although Aristotle certainly takes knowledge to be stable in this sense too: See *Nic. Eth.* VI.3, 1139b.33–4 with *Post. An.* I.2, 72b.3–4, *Soph. El.* 133b.30, *Top.* 130b.15–16, 134b.17, where this is described as a characteristic property of knowledge, and *Top.* 134a.36, where it is associated with *epistēmē* being a state. At *Meno* 97e.2–98a.8, however, it is argued that it is a characteristic of *epistēmē* to "abide" (παραμένειν), where this is elaborated in terms of its ability to reliably guide the knower. Here Plato may have in mind something much closer to stability in the sense required by Aristotle's durability argument, viz., for a mental state to continue to count as knowledge over time. No explicit inference is drawn about the object of knowledge in the *Meno*, however; instead, Socrates argues for recollection as a condition of knowledge acquisition. The Forms *are* made objects of recollection on the standard interpretation of *Phaedo* 77a.1–5, but see Dimas (2003). For the influence of the *Meno* on Aristotle's thinking about knowledge, see Ferejohn (2013, esp. 60–71) and Bronstein (2016, 11–30).

7. ἀκίνητον, *Timaeus* 51e.4.

object (the Forms, characterized explicitly as "the most stable things").[8]

Likewise, in the *Cratylus*, Socrates undertakes to ascertain why the ancient name-givers "go round in circles [...] and get dizzy."[9] He suggests that this is *not* on account of "their own internal condition"[10] but rather because the "*things themselves*"[11] they inquire into are "thus in nature, not stable or abiding."[12] That is, Socrates claims that certain people *lack* stable knowledge (they "go around in circles" and "get dizzy") because the *object of their knowledge* is itself unstable, even though their internal condition is otherwise satisfactory. Thus in Plato we already have explicitly the idea that the stability of knowledge requires an object with the requisite stability, and even the idea that no degree of *internal* stability will render knowledge stable if its object fluctuates.

One of Aristotle's contributions is to refine and clarify these arguments using his technical concepts of relatives and states. Aristotle develops the conceptual resources to spell

8. See also *Timaeus* 27d–28a, where a parallel distinction is drawn between "that which always is" (τί τὸ ὂν ἀεί, 27d.6) and "that which always is becoming but never is" (τί τὸ γιγνόμενον μὲν ἀεί, ὂν δὲ οὐδέποτε, 28a.1), and it is immediately inferred that the former type of thing can be "grasped with an account by the mind" (νοήσει μετὰ λόγου περιληπτόν, 28a.1–2) because it is "always in the same condition" (ἀεὶ κατὰ ταὐτὰ ὄν, 28a.2; the appearance of the preposition κατά here is noteworthy given Aristotle's theory of predication καθ' αὐτὸ). The famous discussion of objects of knowledge and belief in *Republic* V and VI, on the other hand, does not contain any overt inference from the stability of knowledge to the stability of its object. That knowledge, unlike belief, is "infallible" (ἀναμάρτητον, 477e.6) is what supports the premise that belief and knowledge are different capacities (*Rep.* V, 477e); it is then argued on the basis of the general thesis that different capacities have different objects that knowledge and belief must be "said over" (ἐπί, 478a.6) different things. In the image of the divided line at *Rep.* VI, 510d–511e, the primary comparison is between the "clarity" (σαφηνείας, 511e.3) of a mental state and the "truth" (ἀληθείας, 511e.3) of its object.

9. ὑπὸ τοῦ πυνκὰ περιστρέφεσθαι [...] εἰλιγγιῶσιν, *Cratylus* 411b.6–7.

10. τὸ ἔνδον τὸ παρά σφίσιν πάθος, *Cratylus* 411c.1.

11. αὐτὰ τὰ πράγματα, *Cratylus* 411c.2, my emphasis.

12. οὕτω πεφυκέναι, οὐδὲν αὐτῶν μόνιμον εἶναι οὐδὲ βέβαιον, *Cratylus* 411c.2–3. *Cratylus* 437a.8, where βέβαιον occurs in the sense of "certain" after "knowlededge" (ἐπιστήμη) in a list of etymologies of terms for knowledge, also demonstrates the close association of knowledge with stability for Plato.

out precisely how, and in what way, knowledge is both dependent upon and ought to be independent from changes in the external world. Rather than resting content with an analogy between the character of knowledge and its object,[13] he characterizes knowledge and its object in such a way that a logical contradiction would result from the failure of knowledge to have a sufficiently stable object.

Yet Aristotle's contribution is not merely to provide new arguments for a traditional position. In this chapter, I argue that Aristotle considers and rejects what he takes to be the strategy of his predecessors, to respond to the problem of reconciling the stability of our knowledge with the changeability of mundane particulars by positing separate, unchanging individuals. In holding that we know necessities, Aristotle is not claiming that we only know about things that exist necessarily. He is rather claiming that scientific knowledge is restricted to the aspects of things that hold of them across all cases and times, in virtue of the kinds to which they belong. His claim is that knowledge grasps unchanging relationships between *kinds* of things, not that it grasps kinds of *imperishable things*. Aristotle thus seeks to delimit the types of things we know without introducing a new class of individuals to serve as the things *about* which we know, as he takes those who introduced Forms to have done. In order to maintain this position, Aristotle must argue that there can be necessary truths even about kinds whose members are perishable. I argue that his theory of predication *per se* provides this, and sketch an account of how this works in natural science.

## 3.1 The introduction of the Forms

According to Aristotle, the Forms were first introduced into philosophy for the purpose of providing a stable object of knowledge. In *Metaphysics* M.4, he remarks:

13. Cf. T3 (p. 27).

**T25** those who speak about them came to believe in Forms because they were persuaded of the truth of the Heraclitean argument that all perceptibles are always in flux, so that if there really is to be knowledge, or wisdom, of anything, there will need to be some other, stable nature besides the perceptibles, there being no knowledge of things in flux[14]

Aristotle claims that those who first posited the Forms did so because they were persuaded that our knowledge must be of something stable, and they believed that no object of perception was stable in the requisite way.[15] Aristotle thinks the object of knowledge was not, then, *identified* with some pre-existing notion of a Form by his predecessors; rather, they were introduced as theoretical posits[16] by some group of philosophers who accepted the following "Heraclitean"[17] argument:

1. All objects of perception are in flux.
2. No object of knowledge is in flux.
3. Therefore, no object of knowledge is an object of perception.[18]

While he avoids the language of "flux," we have seen that Aristotle himself rules out changing perceptible particulars as objects of knowledge on the grounds that they are

14. συνέβη δ' ἡ περὶ τῶν εἰδῶν δόξα τοῖς εἰποῦσι διὰ τὸ πεισθῆναι περὶ τῆς ἀληθείας τοῖς Ἡρακλειτείοις λόγοις ὡς πάντων τῶν αἰσθητῶν ἀεὶ ῥεόντων, ὥστ' εἴπερ ἐπιστήμη τινὸς ἔσται καὶ φρόνησις, ἑτέρας δεῖν τινὰς φύσεις εἶναι παρὰ τὰς αἰσθητὰς μενούσας· οὐ γὰρ εἶναι τῶν ῥεόντων ἐπιστήμην, *Met.* M.4, 1078b.12–17. Cf. *Met.* A.6, 987a.32–b.1.

15. As we have seen, this fits with *Timaeus* 51d, where Forms are indeed first introduced into the discussion as things that are "most stable" and "non-perceptible by us." Nevertheless, I will avoid taking a stand on who Aristotle means by "those who speak about [...] the Forms" in T25. The issues are too complex to decide here whether he means Plato, some other group of Academics, both, or neither. For an interesting case *against* taking him to be referring to Plato, see Gerson (2005, 208) and Krämer (1973).

16. Reeve overtranslates but gets the sense right: "The notion of Forms occurred to the people who stated it because..." (Reeve 2016, 220).

17. Nowhere in the suriving fragments of Heraclitus is a clear expression of this argument to be found (even by Heraclitean standards of clarity), but see D 31=DK 55, D 22=DK 56, D 33=DK 107, D 43=DK 108 and the references to secondary literature in Johnstone (2014, 9). At *Met.* A.6, 986a.32–4 the argument is ascribed to Cratylus as well as Heraclitus.

18. Cf. Dancy (2004, 15).

subject to changes that are incompatible with the stability of knowledge.[19] Like those who introduce the Forms, Aristotle indulges no doubt that we really do have knowledge, and infers by *modus tollens* that the objects of knowledge are more "abiding"[20] than any sensible particular.

Aristotle thus seems himself to accept some version of the Heraclitean argument, and responds to the predicament it generates in what may seem to be essentially the same way. And yet he is emphatic in his denial that a theory of knowledge requires the postulation of "Forms." The generally sober prose of the *Posterior Analytics* is interrupted twice to engage in polemic to this effect. In one passage, Aristotle "says goodbye"[21] to the Forms, dismissing them as mere "chatter."[22] In another, he explains, somewhat more patiently:

> **T26** In order for there to be a demonstration, there need not be Forms, or some one thing alongside from the many: But there *does* need to be one thing that is truly said of many. Otherwise there will be no universal, and if there is no universal, there will be no middle term, and hence no demonstration. And so it is necessary for there to be one thing, the same thing in many cases, non-homonymously.[23]

These remarks rehearse a complaint that resonates throughout the corpus: The Forms are otiose. They are idle wheels of theory, unable to perform the theoretical work that they are introduced to do.[24] In this case, his claim is that they are not required to underwrite demonstrations, the types of arguments productive of knowledge.[25] Rather than one thing

19. See section 2.4.

20. μενούσας, *Met.* Z.15, 1078b.16.

21. χαιρέτω, *Post. An.* I.22, 83a.33.

22. τερετίσματα, *Post. An.* I.22, 83a.33. Literally the sound made by chirping cicadas.

23. Εἴδη μὲν οὖν εἶναι ἢ ἕν τι παρὰ τὰ πολλὰ οὐκ ἀνάγκη, εἰ ἀπόδειξις ἔσται, εἶναι μέντοι ἓν κατὰ πολλῶν ἀληθὲς εἰπεῖν ἀνάγκη· οὐ γὰρ ἔσται τὸ καθόλου, ἂν μὴ τοῦτο ᾖ· ἐὰν δὲ τὸ καθόλου μὴ ᾖ, τὸ μέσον οὐκ ἔσται, ὥστ' οὐδ' ἀπόδειξις. δεῖ ἄρα τι ἓν καὶ τὸ αὐτὸ ἐπὶ πλειόνων εἶναι μὴ ὁμώνυμον, *Post. An.* I.11, 77a.5–8.

24. See Cherniss (1944, esp. 1:223–317).

25. *Post. An.* I.2, 71b.17–18.

"alongside"[26] the many (i.e., a Form), Aristotle claims that it just needs to be "true to say"[27] one thing of many, adding that what is truly said must be "the same in many cases, non-homonymously."[28] This one thing said of many, which is nevertheless not alongside the many, is sufficient to underwrite the possibility of demonstration and thus of knowledge.

Aristotle thus seems to think that he can uphold the Heraclitean argument, or something very much like it, without needing to take as the upshot of this argument that Forms are required to provide stable relata for knowledge. Yet this is puzzling. We saw in the last chapter that Aristotle himself argues that the subject of a known predication cannot be a perishable individual, on the grounds that any truth about it would cease to hold when it perished, and hence this truth would not be "necessary" in the requisite sense (viz., eternal truth).[29] Aristotle agrees with those who posit Forms that knowledge must be of something more "abiding." On what grounds, then, does Aristotle take the Forms to be unnecessary, and what is his alternative?

## 3.2 The irrelevance of the Forms

One reason Aristotle gives for holding that Forms "contribute nothing to knowledge"[30] is that proponents of Forms are committed to the idea that a Form like the Human Itself, the Form nominally associated with humans, is only "homonymously" a human.[31] It does not satisfy the "account" of human.[32] The Form Human cannot be something human,

26. παρὰ, *Post. An.* I.11, 77a.5.

27. ἀληθὲς εἰπεῖν, *Post. An.* I.11, 77a.6.

28. ἓν καὶ τὸ αὐτὸ ἐπὶ πλειόνων εἶναι μὴ ὁμώνυμον, *Post. An.* I.11, 77a.9.

29. See section 2.2.1.

30. οὔτε πρὸς τὴν ἐπιστήμην οὐθὲν βοηθεῖ, *Met.* M.5, 15–16.

31. *Post. An.* I.11, 77a.9.

32. *Top.* VI.10, 148a.15–16.

Aristotle argues, since it is eternal and imperishable while humans are mortal.[33] Aristotle holds that the only way knowledge of something *non*-human could help to explain our knowledge of humans would be if that thing had some causal or predicative relationship to humans.[34] To know, say, the things that cause human flourishing might indeed contribute to our knowledge of humans, even though these things are not (or not only) humans. But Aristotle understands the theory of Forms to take the Form Human to be causally and predicatively isolated from humans. It is not a property of humans (not something predicated "in" humans),[35] nor causally related to humans.[36] Consequently, the Form does nothing to explain the possibility of knowledge of humans.[37]

The fact that Aristotle makes this criticism shows us something important about how he interprets the Heraclitean argument. Aristotle evidently does not understand the conclusion in such a way that would imply that there is no knowledge about humans, since he criticizes the Form-theorist on the grounds that they fail to explain the possibility of this type of knowledge. The Form theorists, as Aristotle depicts them, *do* however take the argument this way. Thus Aristotle's argument from the inability of the Forms to explain knowledge of mundane particulars is to a certain extent question-begging. The proponent of Forms can simply bite the bullet and maintain that we do not know anything of regular humans; that the only possible objects of knowledge are supramundane Forms like the Human Itself.

Perhaps recognizing this, Aristotle presses his criticism further, and mounts an argument that does not rely on the presupposition that we have knowledge about the mundane

33. *Top.* VI.10, 148a.16.

34. Cf. *De An.* I.1, 402b.20–22.

35. *Met.* M.5, 1079b.17. Cf. *Parmenides* 153d, where Socrates denies that the Forms are "in" their participants.

36. *Met.* M.5, 1079b.19. Aristotle dismisses the idea of Forms as "final ends" as "poetic metaphor" at *Met.* M.5, 1079b.26; cf. *Nic. Eth.* V.11, 1138b.5–13.

37. Cf. *Met.* A.9, 991a.8–b.9. On this further see Cherniss (1944, 1:376–80).

things that we ordinarily take ourselves to. This argument aims to establish that, rightly understood, the Forms are not only no help in explaining our knowledge of "other things;" positing them does not even help us understand how we know *about Forms themselves*. The argument rests crucially on the assumption that the Form *F*-Itself is intended to be a *particular*:[38]

> **T27** Nor is it possible to define any Idea: For the Idea is one of the particulars, as they say, and separate. But the account will need to consist of names, yet the person defining does not make [the definition] a name, for it [the definition] will [then] not be an object of knowledge. [Rather] the things [the person defining] sets forth are common to everything [sc., that fits that definition] and thus necessarily apply to something else.[39]

This argument occurs in *Metaphysics* Z.15 following the passages discussed in the previous chapter.[40] Whereas Aristotle's argument in the first part of *Metaphysics* Z.15 seeks to establish there is no knowledge of a truth whose subject term names a *perceptible* and therefore *perishable* particular,[41] here Aristotle generalizes his argument in order to conclude that there is strictly no knowledge of any truth whose subject is a name for a particular at all, perceptible or not.[42] If Forms are particulars, and no particular can be an object of knowledge, it follows that there can be no knowledge of the form "F is P," where F is a Form.[43]

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38. Dancy (2004, 14) expresses pessimism regarding the possibility of extracting such a position from the Platonic dialogues. I will not attempt to do so here: See note 15 on p. 94.

39. Οὐδὲ δὴ ἰδέαν οὐδεμίαν ἔστιν ὁρίσασθαι. τῶν γὰρ καθ' ἕκαστον ἡ ἰδέα, ὡς φασί, καὶ χωριστή· ἀναγκαῖον δὲ ἐξ ὀνομάτων εἶναι τὸν λόγον, ὄνομα δ' οὐ ποιήσει ὁ ὁριζόμενος (ἄγνωστον γὰρ ἔσται), τὰ δὲ κείμενα κοινὰ πᾶσιν· ἀνάγκη ἄρα ὑπάρχειν καὶ ἄλλῳ ταῦτα, *Met.* Z.15, 1040a.8–12.

40. See section 2.4.

41. *Met.* Z.15, 1039b.27–28, 30–31.

42. Cf. Ross (1958b, 2:213); also Frede and Patzig (1988, 2:280).

43. I take "Idea [ἰδέα]" here to be synonymous with "Form [εἶδος]."

The argument relies on the assumption that anything we can know about can be the subject of a *definition*, a simplification of the assumption made above that it can be the subject of a demonstration or a definition.[44] First, Aristotle rules out the case that a definition of a particular could be a name, or consist of names. To give something a name does not contribute to providing knowledge of it. A definition must answer the question "what is it?" not simply by labelling it, but by giving an informative account of what it is to be that thing. Hence a definition will need to have some descriptive content. But any description is such as to apply to a broader class of things in principle, even if no other actually existent thing ever satisfies it. Hence no definition can be a definition of a particular, since any definition will apply in principle to something *other* than the particular that it is supposed to be the definition of:

**T28** For example, if someone were to define you, they will say that you are an animal that is thin or pale or another thing that applies to something else.[45]

Aristotle's point is muddied by his choice of transient attributes for putative definientia of "you," since this suggests that he means that a definition of a particular would need to include some transient attribute, like being pale or thin. No such implication should be understood here. His point is that, no matter what description we choose to put into a definition of *you*, we will end up with something that at least *in principle* applies to a broader class of animals.[46] That is enough to make the putative definition fail. Compounding a list of descriptions, or resorting to genus and species terms, Aristotle clarifies, will not help.[47] No finite list of descriptions will ever serve to pick out no possible

44. This simplification is perhaps licensed by Aristotle's assimilation of demonstrations to complex definitions in *Posterior Analytics* II.8–10.

45. οἷον εἴ τις σὲ ὁρίσαιτο, ζῷον ἐρεῖ ἰσχνὸν ἢ λευκὸν ἢ ἕτερόν τι ὃ καὶ ἄλλῳ ὑπάρξει, *Met.* Z.15, 1040a.12–14.

46. Cf. Ross (1958b, 2:214).

47. *Met.* Z.15, 1040a.12–17.

entity other than *you*, since a description as such applies to anything *else* that satisfies that same description.

This argument does not rely on the subjects of truths like "this human is a two-footed animal" being *perishable* particulars. It rather turns on the idea that any description at all will *in principle* extend to a different possible particular also satisfying that description. Aristotle thus clarifies that eternally existent particulars are in fact no better off than transient particulars when it comes to their definability:

> **T29** It escapes our notice that it is impossible to define [particulars] even in the case of eternal ones, most of all when they are unique, like the sun or the moon. For not only do people go wrong by adding things of the kind which, when abstracted, it will still be the sun, as when [they say that it is] the thing that revolves around the earth or is covered by night (for even if it stood still or shone [during the night], it would no less be the sun: For "the sun" signifies a substance), but it's also the case that these things could be true of other things, i.e., if something else became like this, that would make it the sun, and the account would therefore be common to them: But it was supposed to be of the sun, the individual, just like Cleon or Socrates[48]

Eternal particulars also cannot be subjects of definition, Aristotle maintains. For even when there is a description available that only ever applies to the particular in question, such a description can still never serve as a definition of it. He gives two powerful, and surprisingly modern, arguments for this conclusion, working with the sun as an example of an imperishable particular. First, Aristotle points out that even if the sun ceased to have the properties stated in that description, it would not cease to be the sun. If we imagine that the sun *were* to stand still (even if we grant that it never *will*), that would

48. λανθάνει ὅτι ἀδύνατον ὁρίσασθαι ἐν τοῖς ἀϊδίοις, μάλιστα δὲ ὅσα μοναχά, οἷον ἥλιος ἢ σελήνη. οὐ μόνον γὰρ διαμαρτάνουσι τῷ προστιθέναι τοιαῦτα ὧν ἀφαιρουμένων ἔτι ἔσται ἥλιος, ὥσπερ τὸ περὶ γῆν ἰὸν ἢ νυκτικρυφές (ἂν γὰρ στῇ ἢ φανῇ, οὐκέτι ἔσται ἥλιος· ἀλλ' ἄτοπον εἰ μή· ὁ γὰρ ἥλιος οὐσίαν τινὰ σημαίνει)· ἔτι ὅσα ἐπ' ἄλλου ἐνδέχεται, οἷον ἐὰν ἕτερος γένηται τοιοῦτος, δῆλον ὅτι ἥλιος ἔσται· κοινὸς ἄρα ὁ λόγος· ἀλλ' ἦν τῶν καθ' ἕκαστα ὁ ἥλιος, ὥσπερ Κλέων ἢ Σωκράτης, *Met.* Z.15, 1040a.28–1040b.2.

not cause it to cease being the sun.[49] Second, he points out that if one of these really was a definition of the sun it would be possible for there to be a second sun: Any further object that went around the earth, or that was obscured at night, would count as another sun. The absurdity in this is not the cosmological impossibility of heavenly bodies multiplying. Rather, Aristotle's point is that these cannot have been adequate definitions even of *our* sun or moon, since, if they were, we *would* count anything that satisfied the unique description of the sun (anything that went around the earth and was obscured by night) as another sun – but in fact we would not.[50]

The sun and moon, Aristotle makes clear in closing, are thus no different in respect of definability from other particulars like Cleon or Socrates.[51] This makes it clear that the argument that we cannot know *perceptible* particulars was only a preliminary to a stronger conclusion: On Aristotle's view, the reason we cannot have definitional knowledge of *perceptible* particulars is ultimately that we cannot have definitional knowledge of *particulars* at all, regardless of whether these are perishable, eternal, or even, like the sun and the moon, eternal and the sole members of their kinds.[52] In the case of perceptible particulars, we can appeal to their perishability in order to establish that they cannot be defined by a type of durability argument. But in fact *any* particular, perishable or not, is impossible to

49. That Aristotle makes this argument is strong evidence against the claim of Hintikka (1979) that Aristotle has only a temporal conception of modality, that is, that Aristotle does not distinguish between necessary truth and truth at all times. Although Aristotle takes *one* sense of "necessary" to be equivalent to necessary truth (T18 on p. 75), here Aristotle is effectively distinguishing between truth at all times and definitional necessity. On this issue, see further van Rijen (1989), Barnes (1997), and Detel (1993, 2:121–22 et passim).

50. Compare Kripke's point that even if someone else turned out to have discovered the incompleteness theorem and Gödel stole it and published it under his name, we would keep calling Gödel "Gödel" and would not begin calling the real discoverer of the incompleteness theorem "Gödel"; hence the name Gödel cannot *mean* "whoever discovered the incompleteness theorem". See Kripke (1980, 83–92).

51. *Met.* Z.15, 1040b.1–2.

52. μοναχά, *Met.* Z.15, 1040a.29.

define and thus cannot be the subject of a scientific knowledge claim.[53]

Aristotle thus extends the Heraclitean argument over the course of *Metaphysics* Z.15 in a way that undermines its interpretation by those who would respond to it by postulating additional, unchanging particulars. The conclusion to be drawn from the Heraclitean considerations is not that the definitions which impart knowledge are definitions of *eternal* rather than *perishable* individuals, but rather that definitions (and, a fortiori, definitions the grasp of which imparts knowledge) are not of *individuals* at all. Once this is understood, the temptation to multiply eternal individuals in the service of a theory of knowledge disappears. What is needed, instead, is an account of what secures the truth of definitional predications. This is a task Aristotle undertakes in *Posterior Analytics* I.4–6.

## 3.3 Essentiality and necessity: *Posterior Analytics* I.4

The first book of the *Posterior Analytics* investigates scientific knowledge under the supposition that the propositions we know may be cast as premises and conclusions of demonstrations. It thus approaches the question of what we know by characterizing, in the first instance, the content and modal status of demonstrative premises and conclusions, treating this as a central task in the theory of demonstration. Aristotle begins this task in *Posterior Analytics* I.2, stating that demonstrative premises must be "true, primary, immediate, better known, prior and explanatory of their conclusions."[54] He takes up the task again, in a more systematic way, in *Posterior Analytics* I.4–6. In *Posterior Analytics* I.4, Aristotle describes his task as determining the types of things that demonstrations are "of"

53. Cf. Frede and Patzig (1988, 2:280), who however seem ultimately to take the claim established in the chapter only to be that *perceptible* individuals are indefinable. But Aristotle must intend the conclusion to be broader than that if it is meant to establish that Forms are indefinable.

54. ἀληθῶν τ' εἶναι καὶ πρώτων καὶ ἀμέσων καὶ γνωριμωτέρων καὶ προτέρων καὶ αἰτίων τοῦ συμπεράσματος, *Post. An.* I.2, 71b.21–2.

and "from" – that is, the character of their premises and conclusions[55] – given that both demonstrative conclusions and demonstrative premises hold of "necessity."[56]

His answer is that both demonstrative premises and demonstrative conclusions are necessary in the sense that they hold "in themselves" or "*per se*."[57] He defines three senses of holding *per se*, along with two other related conditions. Let us begin by considering these conditions in turn, and in what sense each is intended to capture a form of necessity.

### *3.3.1 "Of all" and "*per se*"*

Aristotle begins the chapter by defining what it means to hold "of all:"

> **T30** I say that something holds "of all" that does not hold in some cases but not in others, nor sometimes and sometimes not, for example, if animal is said of all human, then if it is true to say that this is a human, it is also true to say that it is an animal, and if the former is now the case, so is the latter.[58]

Aristotle is describing one type of predicative link that holds between a pair of terms like "animal" and "human." The predicative relationship Aristotle is defining here is a stronger one than the condition of being a universally quantified proposition. As described here, the condition has both an extensional and a temporal component. A predicate holds

55. The Greek phrase is ἐκ τίνων καὶ ποίων αἱ ἀποδειξεις εἰσίν (73a.25). If ποίων is taken to be in apposition with τίνων, then Aristotle is only saying that he intends to investigate what the *premises* of demonstrations are like. But in light of the evidence that Aristotle takes the fourth sense of *per se* to apply to demonstrative conclusions (see below) it seems best to take ποίων separately, as referring the quality of demonstrative conclusions (the things demonstrations are "of"). For this reading see also Bolton (1997, 115), Mignucci (1975, 56), Philoponus *in An. Post.* 58,20–23 and Themistius *Paraphrasis* 10,6–7.

56. *Post. An.* I.4, 73a.22–25.

57. For premises: *Post. An.* I.6, 74b.6–11, *Post. An.* I.4, 73a.25. For conclusions, *Post. An.* I.6, 75a.29–30, *Post. An.* I.4, 73a.25.

58. Κατὰ παντὸς μὲν οὖν τοῦτο λέγω ὃ ἂν ᾖ μὴ ἐπὶ τινὸς μὲν τινὸς δὲ μή, μηδὲ ποτὲ μὲν ποτὲ δὲ μή, οἷον εἰ κατὰ παντὸς ἀνθρώπου ζῷον, εἰ ἀληθὲς τόνδ' εἰπεῖν ἄνθρωπον, ἀληθὲς καὶ ζῷον, καὶ εἰ νῦν θάτερον, καὶ θάτερον, *Post. An.* I.4, 73a.28–31.

"of all" of its subject if the predicate term holds not only of every individual which falls under the subject term, but also of these individuals at all times.

Although Aristotle does not say so explicitly, his examples suggest that the relevant individuals include not only all actual, but all possible instances of the subject term: If it is true to say of any *possible* thing that it is human, then it is true to say that it is an animal, etc. If this is what he means, then this is already a highly intensionalised condition, and it can already be viewed as one sense of "necessary" in which Aristotle takes knowledge to be necessary.[59]

Aristotle then proceeds to define four senses of "in itself" or *per se*, the first, second and fourth of which are ways in which a predicate may be related to a subject.[60] The first two senses are defined together:

> **T31** Things are *per se* both which are predicated in the essence, as line is for triangle and point for line (for their essence is composed of them, and they are predicated in the account that says what they are), and also those predicates for which they [sc., their subjects] are predicated of them [sc., the predicates] in the account which makes clear what they [sc., the predicates] are, as straight holds of lines and curved does, and odd and even of number, and prime and composite, and equilateral and oblong: For line, in one case, and number, in the other, holds of all of these things in the account that says what they are.[61]

A predicate is a *per se* predicate of some subject in the first sense (*per se*$_1$) if that predicate appears "in the account specifying what the subject is," while a predicate is a

59. Cf. Detel (1993, 2:99).

60. The third sense is a non-relational notion: A substance is called a being *per se* (*Post. An.* I.4, 73b.7). For a different reading, see Peramatzis (2010, 158–59).

61. Καθ' αὐτὰ δ' ὅσα ὑπάρχει τε ἐν τῷ τί ἐστιν, οἷον τριγώνῳ γραμμὴ καὶ γραμμῇ στιγμή (ἡ γὰρ οὐσία αὐτῶν ἐκ τούτων ἐστί, καὶ ἐν τῷ λόγῳ τῷ λέγοντι τί ἐστιν ἐνυπάρχει), καὶ ὅσοις τῶν ὑπαρχόντων αὐτοῖς αὐτὰ ἐν τῷ λόγῳ ἐνυπάρχουσι τῷ τί ἐστι δηλοῦντι, οἷον τὸ εὐθὺ ὑπάρχει γραμμῇ καὶ τὸ περιφερές, καὶ τὸ περιττὸν καὶ ἄρτιον ἀριθμῷ, καὶ τὸ πρῶτον καὶ σύνθετον, καὶ ἰσόπλευρον καὶ ἑτερόμηκες· καὶ πᾶσι τούτοις ἐνυπάρχουσιν ἐν τῷ λόγῳ τῷ τί ἐστι λέγοντι ἔνθα μὲν γραμμὴ ἔνθα δ' ἀριθμός, *Post. An.* I.4, 73a.34–73b.2.

*per se* predicate of some subject in the second sense (*per se*$_2$) if that subject inheres in the account specifying what the predicate is. As examples of predicates that are *per se*$_1$, Aristotle gives "line of triangle and point of lines."[62] These are *per se*$_1$ predicates of their respective subjects because the definitions of triangle and line (the "accounts specifying what the subject is") mention lines and points respectively: A triangle is a plane figure bounded by three *lines*, and a line in turn is defined in terms of points.[63] These things *constitute* the essence of their subjects in the sense that a triangle *just is* lines standing in a certain configuration, while a line just is points standing in a certain configuration. To say that a triangle is bounded by lines is consequently to make a special type of predication of triangles: Triangles do not just "happen" to be bounded by lines; they are bounded by lines because *to be a triangle* just is *to be a figure bounded by three lines*.

Aristotle illustrates the second sense by saying that it is in this way that "straight holds of lines and so does curved, and odd and even of numbers."[64] In this case, the direction of inherence is reversed: A predicate is a *per se* predicate of some subject in the second sense (*per se*$_2$) if that subject is part of the essence of the predicate. But Aristotle does not seem to mean that the relation of being a *per se*$_2$ predicate is simply the converse of the relation of being a *per se*$_1$ predicate, i.e., that if P is a *per se*$_1$ predicate of S, then S is a *per se*$_2$ predicate of P. Elsewhere he associates this type of predication with one that reveals the predicate's "primary subject,"[65] the most generic type of thing to which that predicate applies, and this fits with the examples he gives here. Thus to be straight (curved) is to

62. τριγώνῳ γραμμὴ καὶ γραμμῇ στιγμή, *Post. An.* I.4, 73a.35.

63. The definition Aristotle has in mind is probably not the one we would take to be most natural, viz. a region of space connecting two points. Philoponus (*in An. Post.* 60,24) and McKirahan (1992, 86) claim that a line is to be defined as the motion of a point; cf. *De An.* I.4, 409a.5. Barnes (1993, 113) however claims that this is a "non-Aristotelian definition."

64. *Post. An.* I.4, 73a.38–41.

65. ὑποκείμενον [...] πρῶτον, *Met.* Δ.18, 1022a.19, 30. Possibly also *Met.* Δ.18, 1022a.30–31 and *Met.* Z.4, 1029b.17–18 (on which see Peramatzis 2010).

be a certain kind of line, and so for this reason the account saying what it is to be straight must mention lines. In the same way, to be even is to be a *number* capable of being divided into two equal parts,[66] while to be odd is to be a *number* that lacks this property, and for this reason saying what it is to be odd or even must mention number. Aristotle infers that a predicate which holds *per se*$_2$ of its subject likewise holds of it in a special way:[67] Some numbers are even because *to be* even is to be a certain kind of number. Thus, again, it is not simply that some numbers *happen* to be even while others are odd;[68] instead, some numbers are odd because to be odd just is to be a number that is not equally divisible into parts.

Aristotle thus holds that true predications in which the predicate is a *per se*$_1$ or *per se*$_2$ predicate of the subject term (I will call these *per se*$_1$ predications and *per se*$_2$ predications respectively) are true "*on account of*" the terms involved.[69] *Per se*$_1$ predications are true on account of the subject term having a definition which the predicate forms a part of; *per se*$_2$ predications are true on account of the predicate term having a definition which the subject forms a part of. The contrast case is a predication like "(some) animals are cultured" or "(some) animals are pale:"[70] Even though both of these are true, it is neither the case that being cultured (or pale) is part of what it is to be an animal, nor the case that "*animal*" specifies the primary subject of being cultured (this being rather "human") or pale (this being rather "surface").[71]

Aristotle also takes there to be predications that are true on account of the terms

66. Cf. Philoponus *in An. Post.* 61,17–19.

67. I owe this way of putting the matter to Bronstein (2016, 45). I do not however follow Bronstein (2016, 48–51) in taking Aristotle to be committed to the claim that all *per se*$_2$ predications are ultimatley grounded in *per se*$_1$ predications.

68. *Post. An.* I.4, 73b.4–5.

69. δι' αὐτά, *Post. An.* I.4, 73b.18.

70. *Post. An.* I.4, 73b.5.

71. *Met.* Δ.18, 1022a.30–31.

involved without the predicates being either *per se*$_1$ or *per se*$_2$, however. These are predications where the definitions of the two terms explain the truth of the predication without one being part of the definition of the other. The predicates of such predications are said to be *per se* of their subjects in yet another sense, the fourth Aristotle defines in the chapter (*per se*$_4$).[72] Aristotle's example is that "the sacrifical animal [lit., the throat-slit thing] dies."[73] This is true *per se* because the sacrifical animal dies "in accordance with the sacrifice" and thus "*on account of* its throat being cut:"[74] It does not "just happen" that its throat is cut and then it dies.[75] The contrast case given is that it thunders while someone is walking: This is a "coincidence" in that thunder "coincides"[76] with walking, without take place "on account of"[77] the walking, nor does the walking taking place on account of the thunder. While it is not incidental in this way, Aristotle takes the connection between something having its throat cut and dying also not to be one of (partial) definition: It is neither the case that part of what it is to have one's throat cut is to die (an animal might survive throat-cutting), nor is it the case that part of dying is to have one's throat cut (there are other ways of dying). Nevertheless, a throat-slitting that in some sense reaches its culmination *does* result in death, and thus it is in a broad sense *essential* to having one's throat cut that something dies, even though the connection is not invariable

72. I omit discussion of the third sense, which is not a type of predication but rather denotes substance. See note 60 on p. 104.

73. σφαττόμενον ἀπέθανε, *Post. An.* I.4, 73b.14

74. *Post. An.* I.4, 73b.15.

75. συνέβη, *Post. An.* I.4, 73b.15.

76. συνέβη, *Post. An.* I.4, 73b.13.

77. διὰ, *Post. An.* I.4, 73b.12.

or immediately one of definition.[78]

Aristotle claims that all premises of demonstrations are necessary because the predicate of the subject is a *per se* predicate of its subject in the first or second sense.[79] The conclusions of demonstrations are those in which the predicate is *per* $se_4$, but not *per* $se_1$ or *per* $se_2$.[80] Although *per* $se_4$ predications do not themselves express definitional connections, then, Aristotle holds that they are deducible from truths that are *per se* in the first two senses. The idea, then, is that demonstrations prove non-definitional but non-incidental facts from definitional facts. Non-definitional but non-incidental connections that are knowable in science are thus viewed as the logical consequences of definitional truths.

### *3.3.2* Per se *predications and necessity*

Aristotle claims that "objects of knowledge without qualification"[81] are necessary because they are *per se* predications in the first two senses.[82] While Aristotle normally uses "object of knowledge" to refer to the conclusion of a demonstration, he appears here to be using it to refer to the premises of demonstrations, since he goes on to clarify explicitly that these two senses of *per se* apply to the indemonstrable *premises* of demonstrative proofs,

78. Cf. however Ferejohn (2013, 109–31), who, noting this, concludes that *per* $se_4$ predications are true merely for the most part. Aristotle characterizes the conclusions of demonstrations as *per se* in this fourth sense at 75a.35–7, and argues that the premises of demonstrations are necessities in that chapter. In *Post. An.* I.30, he claims that demonstrations with necessary premises give rise to necessary conclusions. It thus seems that Aristotle is committed to *per* $se_4$ propositions also being necessary. What is necessary in this sense is the *generic* statement: *It is necessary that throat-slitting leads to death*, even though it is not necessary that any individual instance of throat-slitting results in death. I discuss this issue further in chapter five.

79. *Post. An.* I.4, 73b.16–18.

80. See *Post. An.* I.6, 75a.34–7.

81. τῶν ἁπλῶς ἐπιστητῶν, *Post. An.* I.4, 73b.16.

82. *Post. An.* I.4, 73b.16–18. Cf. 73a.34–38.

taking conclusions to be *per se* truths in the fourth sense alone.[83] Aristotle's first claim is thus that if a predication with predicate P and subject S is true, and P forms a part of the definition of S, then that predication is true of necessity; likewise, if S forms a part of the predicate P by describing its primary subject, then the predication will also hold of necessity.

That *per se*$_1$ predications are necessary is clearest in the case of universal affirmative necessities. The fact that all triangles are bounded by lines is true of necessity, on this account, because it is part of what it is to be a triangle that it is a figure bounded by three lines, and *therefore* a figure bounded by lines. Thus, nothing could be a triangle without also being a figure bounded by lines. It does not follow that in a *per se* predication the predicate always refers to a mathematical kind like triangle, however. Themistius plausibly expands Aristotle's examples with the example of a human being an animal and a tree being a plant as *per se* in this sense: It is part of the definition of a human to be an animal, with the consequence that any human *must* be an animal; anything that was not an animal would not *be* a human.[84] That is compatible with humans being perishable, and thus at some point in time ceasing to be humans and *therefore also* ceasing to be animals.

It is less clear how predications *per se* in the second sense generate necessities. It is, after all, not necessarily true that all lines are straight, or that all numbers are odd. Aristotle's view on this issue is complicated. The first sense in which *per se*$_2$ predications are necessary is connected with the fact that the subject term picks out the "primary" subject of that predicate. What Aristotle means is that the subject term of this type of predication is the broadest possible subject to which the predicate applies, and that it always applies to things designated by this term. The predication "even is said of numbers" is thus "necessary," first, in the sense that it is necessarily *numbers* that are odd; nothing other than a number can

83. On the issues here, see McKirahan (1992, 98–101).

84. Themistius, *Paraphrasis* 10,24–25.

have the property "odd." But this is not the necessity associated with *per se*$_2$ predications that Aristotle emphasizes.[85] He elaborates in a notoriously difficult passage:

> **T32** It is not possible for [*per se*] predicates not to hold, either directly or for the opposites, for example straight holds of a line, or curved does, and even holds of a numbers, or odd does. For a contrary is a privation or a contradictory in the same kind, for instance even is what is not odd among numbers in so far as it follows. And so, if it is necessary to assert or deny, then *necessarily* the *per se* attributes will apply.[86]

*Per se*$_1$ predications are necessary "directly."[87] Aristotle does not elaborate on what he means by this, but presumably the idea is that the only types of *per se*$_1$ predications are either universal affirmatives or those in which a corresponding universal affirmative necessity anyway holds (if some humans are animals, this can only be because all humans are animals, given that "animal" is part of the definition of "human"). As such, any *per se*$_1$ predication will be necessary in the sense outlined in the previous paragraph: Anything which satisfies the subject term must also satisfy the predicate term, since the predicate term is simply an immediate consequence of the definition of the subject.

In some cases, a *per se*$_2$ predication may also be "directly" necessary in this way. Aristotle elsewhere gives the example of color predicated of surface.[88] This is a *per se*$_2$ predication because it is part of what it is to be a color to inhere in a surface, just as it is part of what it is to be odd to be a number. Thus it is necessary that anything which is colored is a surface. But it is also necessary that all surfaces are colored, because "being colored"

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85. Contra McKirahan (1992, 90–91). McKirahan takes Aristotle's elaboration in T32 to express an "ill-fated doctrine" (McKirahan 1992, 91).

86. οὐ γὰρ ἐνδέχεται μὴ ὑπάρχειν ἢ ἁπλῶς ἢ τὰ ἀντικείμενα, οἷον γραμμῇ τὸ εὐθὺ ἢ τὸ καμπύλον καὶ ἀριθμῷ τὸ περιττὸν ἢ τὸ ἄρτιον. ἔστι γὰρ τὸ ἐναντίον ἢ στέρησις ἀντίφασις ἐν τῷ αὐτῷ γένει, οἷον ἄρτιον τὸ μὴ περιττὸν ἐν ἀριθμοῖς ᾗ ἔπεται. ὥστ' εἰ ἀνάγκη φάναι ἢ ἀποφάναι, ἀνάγκη καὶ τὰ καθ' αὑτὰ ὑπάρχειν, *Post. An.* I.4, 73b.18–24. Deleting ἢ before ἀντίφασις with Barnes.

87. ἁπλῶς, *Post. An.* I.4, 73b.19 (T32).

88. *Met.* Δ.18, 1022a.18.

describes a property that surfaces have at the level of the entire genus rather than only one special type of surface. Consequently nothing could be a surface without being colored, just as nothing could be a human without being an animal.

Aristotle does not, however, hold that *per se*$_2$ predicates will always hold as universal affirmative necessities.[89] "The opposites"[90] holding of necessity describes the way that *per se*$_2$ predications generate necessities in cases where no such "direct" necessity is available. Aristotle's idea is that in such cases where a *per se*$_2$ predication holds but does not exhaust the subject term, it will be one of a *pair* of *per se*$_2$ predicates of that subject, where the predicate of one is the privation or contradictory of the predicate of the other in the genus given by that subject. That is, in a predication like "some numbers are odd," where "odd" does not span the entire genus of number, there is another predicate, "even," such that odd and even together span the genus of number. Each of these *per se*$_2$ predicates holds *necessarily* of some sub-class of the subject term, and together the pair of *per se*$_2$ predicates *exhaust* the subject term. Thus, if asked whether a given number is even, it will be possible to *assert* this with necessity, or to *deny* it with necessity by making a necessary assertion of the predicate's contrary or privation.[91]

That is, a predication is *per se* in the second sense when the predicate and its negation span the entire subject, with each being predicated of the instances it is predicated of necessarily. This is not the trivial claim that

> If $P$ holds of some $S$, then necessarily ($P$ or $\neg P$) holds of every $S$

It is rather the stronger claim that:

89. Barnes (1993, 112) makes the assumption that *per se* predications must always be universal affirmatives. But Aristotle nowhere says this, and this assumption makes it impossible to interpret him consistently, since the examples he gives of *per se*$_2$ predicates plainly do not hold of their subjects universally.

90. τὰ ἀντικείμενα, *Post. An.* I.4, 73b.19 (T32).

91. Cf. *Post. An.* I.4, 73b.23–24 (T32).

If $P$ holds *per* $se_2$ of some $S$, then (i) there is a $T$ such that $S$ holds of all $T$, and $P$ holds necessarily of all $T$, and (ii) there is a $U$ such that $S$ holds of $U$, and $P$ holds necessarily of all $U$, and (iii) every $S$ is either a $T$ or a $U$

The idea here is that a pair of *per* $se_2$ predicates describe the natural kinds into which the subject term may be divided, such that those $S$s of which a $P$ is predicated *per* $se_2$ must be necessarily $P$, even if not all $S$ are $P$.

We may thus identify three necessities associated with each *per* $se_2$ predication in addition to the "direct" necessity that holds of every *per* $se_1$ predication. Collecting these, we have:

1. If $P$ holds *per* $se_1$ of $S$, then $P$ holds necessarily of *all* $S$.
2. If $P$ holds *per* $se_2$ of $S$, then:
   (i) $S$ holds necessarily of all $P$,
   (ii) $P$ holds necessarily of *some* $S$, and
   (iii) there is a $T$ such that $S$ holds of all $T$, and $P$ holds necessarily of all $T$, and there is a $U$ such that $S$ holds of $U$, and $P$ holds necessarily of all $U$, and every $S$ is either a $T$ or a $U$

### *3.3.3 "Universal"*

Having defined "of all" and the various senses of "*per se*," Aristotle defines a new notion, a "universal" predicate, partially in terms of these:

**T33** [I call a predicate a] "universal" if it is predicated of all and *per se* and as such.[92]

92. καθόλου δὲ λέγω ὃ ἂν κατὰ παντός τε ὑπάρχῃ καὶ καθ' αὑτὸ καὶ ᾗ αὐτό, *Post. An.* I.4, 73b.26–27.

To hold "universally" is to hold in the manner of a *per se* predication,[93] an "of all" predication, and to satisfy an apparently new condition, to hold "as such" or, more literally, "*qua* themselves."[94] Aristotle goes on immediately, however, to claim that the "as such" condition is redundant, since "being *per se* and as such are the same."[95] Thus the characteristic form of necessity pertaining to demonstrative premises may be said, interchangeably, to derive from their being true *per se* or their being true "as such:" Being composed of points, Aristotle explains, holds of lines "as lines" as well as "in themselves," and having 2R holds of a triangle not only "in itself" but "*as* a triangle."

Aristotle goes on to give another characterization of "universal" predication:

**T34** A universal holds exactly when it is proven in an arbitrary case and of its primary [subject].[96]

A universal predicate holds of its subject when it holds of its subject "in an arbitrary case" and "as its primary subject." We have already encountered the notion of a primary subject in connection with *per se*$_2$ predication: A predicates's primary subject is a subject term that is sufficiently broad that it includes *all* possible subjects with that predicate; thus anything satisfying the predicate also falls under the subject term. In the case Aristotle uses to illustrate universal predication, a triangle has 2R, this means that triangle is not just one particular shape to which this predicate applies (as in the predication "isosceles triangle has 2R"), but includes *every* shape to which this predicate applies. Aristotle explains what he means by holding "of an arbitrary case:"

93. See below on which sense.

94. ᾗ αὐτό, *Post. An.* I.4, 73b.27.

95. *Post. An.* I.4, 73b.28–39.

96. τὸ καθόλου δὲ ὑπάρχει τότε, ὅταν ἐπὶ τοῦ τυχόντος καὶ πρώτου δεικνύηται, *Post. An.* I.4, 73b.32–4.

**T35** Even though it is possible to show that shapes have 2R, it is not possible to show this to hold of an *arbitrary* shape, nor is it possible to show it using an arbitrary shape: For a square is a shape, but it does not have angles adding up to two right angles[97]

While one can prove that a predication with "shape" as its subject and "2R" as its predicate, since *some* shape does have 2R (namely, a triangle), one cannot prove that an *arbitrary* shape has 2R (squares, among others, do not). In addition to holding of a sufficiently *broad* subject that the subject includes all of the predicate, a universal predication must also have a subject term that is sufficiently narrow that the predicate holds of every case of it ("of all" of it in the sense described above). A universal predication, then, is one in which the subject and predicate terms are necessarily co-extensive: Anything which is a triangle has 2R, and anything which has 2R is a triangle. The terms are necessarily coextensive because the predication is both "of all" and *per se* in the second sense. The "of all" condition ensures that the predicate term holds of an *arbitrary* instance of the subject, while the *per se*$_2$ condition requires the subject term to be the primary subject for that predicate.

This has the consequence that universal predications are necessary in a very strong sense. Universal predications are necessary first of all in so far as they satisfy the "of all" condition: The predicate holds of all instances of the subject, at all times. This requires that the subject term not be so broad as to include things that the predicate does not apply to. But universal predications are also necessary in that the subject describes the things the predicate applies to at a level of generality broad enough to include everything the predicate may possibly apply to, that is, in that they are *per se*$_2$ predications. Universal predications thus form a special class of predications where the subject and the predicate form, as it were, a perfect fit: It is not only the case that the predicate applies to every

97. καίτοι ἔστι δεῖξαι κατὰ σχήματος ὅτι δύο ὀρθὰς ἔχει, ἀλλ' οὐ τοῦ τυχόντος σχήματος, οὐδὲ χρῆται τῷ τυχόντι σχήματι δεικνύς· τὸ γὰρ τετράγωνον σχῆμα μέν, οὐκ ἔχει δὲ δύο ὀρθαῖς ἴσας, *Post. An.* I.4, 73b.34–37.

possible instance of the subject, and in this sense holds of it necessarily, but also that the predicate can hold *only* of things of the kind described by the subject.

### *3.3.4 Demonstrative necessities concerning individuals*

In saying that definitional connections explain the necessity of demonstrative premises, Aristotle does not mean to imply that we grasp these just in virtue of our linguistic competence. The "definitions" in question are "real" definitions, which may require not only linguistic competence but empirical experience and substantial reasoning to discover.[98] What Aristotle means is rather that the propositions that we know as premises and conclusions of definitions derive from facts about what things are: Their essences.[99]

In light of Aristotle's arguments in *Metaphysics* Z.15 that individuals do not have definitions, we may be tempted to infer that *per se* predications can never hold of individuals. Yet while Aristotle often seems to take *per se* predicates to pertain to *kinds* like line and point rather than individual lines and points, he also takes there to be *per se* predications whose subject term is a name of an individual. In his illustration of the senses of *per se* in *Metaphysics* $\Delta$, he illustrates *per se*$_1$ predication as follows:

98. Aristotle explicitly distinguishes these sorts of definitions, which are "indemonstrable accounts of the essence" (94a.11–12) from definitions of what terms "signify" at *Post. An.* II.10, 93b.38–39. On the notion of definition at play and how we learn them, see Charles (2000, esp. chs. 1, 2, and 10), Goldin (1996, esp. chs. 1, 5 and 6), Bronstein (2016, esp. pt. II), McKirahan (1992, chs. 8 and 18) and Ackrill (1981). See also my dicussion in section 4.3.

99. I say something about how we come to know *per se* predications in the next chapter. For a fuller treatment of this issue, see Charles (2002), Bolton (1976), Bolton (1987), and Bronstein (2016).

**T36** *Per se* is necessarily said in many ways. [...] One [sense] is all those [predicates] which are predicated in the essence. For example, Callias is an animal *per se*, since this inheres in the essence: For Callias is a certain kind of animal[100]

Aristotle claims that animal is a *per se* predicate of Callias in the first sense, since animal inheres in the account that says what Callias is. That establishes that *per se* predications are not restricted to statements whose subject is a general term like "human." Callias can stand as the subject of a *per se* predication in the first sense.

In fact this is consistent with the strictures of *Metaphysics* Z.15. For Aristotle is not claiming here that Callias has a definition. He is rather claiming that Callias may stand as the subject of a *per se* predication by courtesy of a definitional fact about his *kind*, human. Animal is a *per se* predicate of Callias because Callias is of the kind human, and part of the definition of the kind human is animal. The general schema suggested is that P is a *per se*$_1$ predicate of some individual if that individual is of kind K, and P is part of the definition of K.[101]

We may also take Aristotle's claims that *per se*$_1$ predications are directly necessary to apply in this case, where the subject term names some individual. However, here the sense of necessity will be slightly different. The fact that animal is a *per se* predicate of Callias means that animal is part of the definition of Callias's kind, human. Thus Callias being an animal is only "necessary" in the sense that Callias must be an animal, given that he is human (i.e., given that he exists). The import of such a "necessity," then, is not that

100. τὸ καθ' αὐτὸ πολλαχῶς ἀνάγκη λέγεσθαι. [...] ἓν δὲ ὅσα ἐν τῷ τί ἐστιν ὑπάρχει, οἷον ζῷον ὁ Καλλίας καθ' αὐτόν· ἐν γὰρ τῷ λόγῳ ἐνυπάρχει τὸ ζῷον· ζῷον γάρ τι ὁ Καλλίας, *Met.* Δ.18, 1022a.25–29.

101. Aristotle does not give an example of a *per se*$_2$ predication involving an individual here, but it would be natural to extend this schema to that case as well. P will be a *per se*$_2$ predicate of some individual ("number" a *per se*$_2$ predicate of "3") if that individual is of kind K and K inheres in the definition of P as its primary subject (as "number" inheres in the definition of "odd"). I will however only consider *per se*$_1$ necessities with individual subjects.

Callias is a necessarily existent animal, but rather that Callias *must* be an animal to the extent that he is a human.[102]

As a consequence of there being *per se* predications of this type, there can also be demonstrations of facts about individuals. Aristotle illustrates this in *Metaphysics* M.10, in the course of explaining what it means for knowledge to be "of the universal:"

> **T37** A syllogism that this triangle has 2R does not come about, *unless* all triangles have 2R, nor does a syllogism that this human is an animal come about, *unless* all humans are animals[103]

Aristotle clarifies that for demonstrative knowledge to be "of the universal"[104] does not mean that only general facts are known by demonstration.[105] It is not that there is no such thing as a demonstration of a fact whose subject is a particular human or a particular triangle,[106] but rather that there can only be such a demonstration *under the condition that the predicate holds of everything of that individual's kind.* This is consonant with what we have seen. A demonstration of the fact that Callias is an animal cannot rely on the definition of Callias, because he does not have one. Instead, the fact that Callias is human counts as a true *per se*$_1$ predication because human is predicated trivially in the account which says "what Callias is" in the sense of describing his *kind* (namely, human). Thus, the demonstration

1. Animal holds of all human
2. Human holds of Callias

102. Cf. Hasper (2006, 259).

103. οὐ γὰρ γίγνεται συλλογισμὸς ὅτι τόδε τὸ τρίγωνον δύο ὀρθαῖς, εἰ μὴ πᾶν τρίγωνον δύο ὀρθαί, οὐδ' ὅτι ὁδὶ ὁ ἄνθρωπος ζῷον, εἰ μὴ πᾶς ἄνθρωπος ζῷον, *Met.* M.10, 1086b.34–37. My emphasis.

104. *Met.* M.10, 1086b.33.

105. Cf. *Post. An.* I.31, 87b.37–88a.17.

106. Cf. *Post. An.* I.1, 71a.19–21.

3. Therefore, animal holds of Callias

is a legitimate demonstration, in which all premises are *per se*$_1$. But the truth condition for the conclusion is that animal is part of the definition of Callias's kind, human. That means that if this fact is demonstrable, it must be the case that animal is predicated of all human. In general, if there is a demonstration of the form "c is F," where this expresses a *per se*$_1$ predication of an individual c, it must also be the case that there is a *per se*$_1$ predication in which F is the predicate and K is the subject, where K is c's kind. But that implies that F holds (necessarily) of all K.[107]

Aristotle's theory of *per se* predication thus extends to individuals as well, because the condition that $x$ is predicated in the account saying what $y$ is can be understood either as meaning that $x$ is part of the definition of $y$, or as meaning that $x$ is part of the definition of $y$'s kind. Aristotle allows there to be definitions of individuals so long as they are apprehended *as* members of their kind. What such demonstrations reflect, however, are not facts provable about the individual as such, but rather facts about the kind that this individual belongs to.

Aristotle discusses this type of knowledge at the end of *Metaphysics* M, where he seeks to explain how can have knowledge of the principles of primary substances, under the assumption that these are particular. His solution is to distinguish between the object of knowledge *in capacity* and the object of knowledge *in activity*:[108]

107. See section 3.3.2.

108. On this passage, see Leszl (1972).

**T38** Knowledge, just like knowing, is said in two ways, of which one is knowledge-in-capacity, the other knowledge-in-activity. The capacity is, as matter, of the universal, and being indeterminate, is of something universal and indeterminate, but the activity, being determinate, is also of something determinate, and, being particular, it is of something particular. But sight sees the universal color accidentally, because the particular color that it sees is a color; likewise what the literate person contemplates, this alpha, is an alpha. [...] It is clear that knowledge is in a way of the universal, and in a way not.[109]

We have already seen that Aristotle's claim that knowledge is of a necessity applies primarily to knowledge as a *state* or intellectual virtue. Here he makes the same claim, more explicitly, regarding the universality of knowledge. This claim that knowledge is of the universal, like his claim that it is of a necessity, does not apply primarily to knowing in the sense of an exercise of our capacity for knowledge, but rather this capacity itself. A capacity and its exercise need not, for Aristotle, have the same object. He clarifies this with the example of the object of sight. It would be a serious error to construe Aristotle's claim that the proper object sight is primarily of a color[110] as meaning that the proper object of sight as a capacity is of a *certain* color (say, red) or, worse, a certain color sample (the red of a certain blouse).[111] Nevertheless, in a different sense sight is of a particular color: Whenever we actually see something, what we see is a *particular* color, not color in general. This may be expressed by saying that the *activity* of seeing has as its object a particular color, and is of the universal color only "accidentally."

Aristotle invites us to take this as a model for thinking about the relationship between

109. ἡ [...] ἐπιστήμη, ὥσπερ καὶ τὸ ἐπίστασθαι, διττόν, ὧν τὸ μὲν δυνάμει τὸ δὲ ἐνεργείᾳ. ἡ μὲν οὖν δύναμις ὡς ὕλη [τοῦ] καθόλου οὖσα καὶ ἀόριστος τοῦ καθόλου καὶ ἀορίστου ἐστίν, ἡ δ' ἐνέργεια ὡρισμένη καὶ ὡρισμένου, τόδε τι οὖσα τοῦδέ τινος, ἀλλὰ κατὰ συμβεβηκὸς ἡ ὄψις τὸ καθόλου χρῶμα ὁρᾷ ὅτι τόδε τὸ χρῶμα ὃ ὁρᾷ χρῶμά ἐστιν, καὶ ὃ θεωρεῖ ὁ γραμματικός, τόδε τὸ ἄλφα ἄλφα· [...] δῆλον ὅτι ἔστι μὲν ὡς ἡ ἐπιστήμη καθόλου, ἔστι δ' ὡς οὔ, *Met.* M.10, 1087a.15–25.

110. *De An.* II.6, 418a.13.

111. The possibility of this misconstrual is obscured by the existence of an indefinite article in English, which distinguishes between "sight is of a color" and "sight is of color." Either could be meant by ἡ ὄψις ἐστὶ χρῶματος.

objects of knowledge as a capacity and its exercise. The determinateness and particularity of an object must match that of which it is an object. Knowledge, as a capacity, is like matter in that it is "indeterminate." What Aristotle means is that it may be realized or employed in a range of possible exercises. Accordingly, what we know, in the sense of what we have a capacity to know, is not any determinate particular. By contrast, an exercise of a knowledge capacity is a particular, determinate event: It is a matter of recognizing some particular thing to have some property that we know why it should have. What we know in any particular exercise of our knowledge capacities is accordingly a determinate particular. The *exercise* of knowledge is "of the universal" only *per accidens*: It is only because the object falls under a universal whose explanation we grasp that knowledge in activity is "of a universal." A grammarian has knowledge of token instances of letters, but her knowledge of them is of the properties they have as members of their kinds.

In place of postulating a new class of unchanging and eternally existent individuals, then, Aristotle gives a theory according to which we can have demonstrative and definitional knowledge of individuals by knowing about their kinds. Aristotle is thus able to accept a certain version of the Heraclitean argument, but he takes the correct conclusion to be that there are no definitional truths about individuals as such; that any truth about an individual is parasitic on a truth known about its kind. In closing this chapter, it will be instructive to examine a couple of concrete cases where Aristotle thinks we may talk sensibly about *per se* necessities with regard to perishable, sensible phenomena.

## 3.4 *Per se* necessity in natural science

### *3.4.1* Per se *necessity in biology:* Parts of Animals *II.3*

Aristotle discusses the way that *per se* predications involving perishable subjects may be considered to express necessities in *Parts of Animals* II.3. There he takes it as established

that the heat of blood is required for it to perform its biological function as blood.[112] It is thus true to say of blood that it is hot, *in so far as it is blood*. In other words, blood is hot *per se*. This raises a puzzle, since according to the theory above this should imply that blood is necessarily hot, yet it is possible for blood to cool, as when an animal bleeds or dies. To resolve this puzzle, Aristotle makes the following distinction:[113]

> **T39** it is clear that "blood" understood in *this* way is hot, namely [as signifying] what it is for it to be blood (just as if we gave a special name to boiling water), whereas the underlying subject, that is, that which is blood at certain times when it is [in the appropriate condition], is not hot [sc., *per se*]. And so in a way blood is hot *per se*, in another way it is not. For heat inheres in the account, just like in the account of pale man pale inheres: But in so far as it is spoken of as an affection, it is not hot *per se*.[114]

When we say "blood is hot," Aristotle holds, we may be using the word "blood" in one of two ways. In one way, we are using it to denote the underlying matter that constitutes blood when it is heated in a living body. In this sense, it is not always true to say "blood is hot," since this substrate can cease to be hot. But we may also use the word "blood," Aristotle claims, to denote the substrate specifically at those times when the substrate of blood is in the appropriate condition to perform its biological function.[115] In this case, the word "blood" functions as if we had given "a special name to boiling water," and thus is necessarily hot. It is worth spelling out this idea in some depth, since it illustrates how Aritsotle takes *per se* necessities, which hold primarily among kinds themselves, to generate necessities at the level of individuals.

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112. Lennox (2001, 198).

113. See also *Part. An.* II.2, 649a.13–24 and the discussion in Sorabji (1980, 202–3).

114. φανερὸν ὅτι τὸ αἷμα ὠδὶ μὲν ἔστι θερμόν, οἷόν τι ἦν αὐτῷ τὸ αἵματι εἶναι (καθαπερεὶ ὀνόματί τινι σημαίνοιμεν τὸ ζέον ὕδωρ, οὕτω λέγεται), τὸ δ' ὑποκείμενον καὶ ὅ ποτε ὂν αἷμά ἐστιν, οὐ θερμόν· καὶ καθ' αὑτό ἐστι μὲν ὡς θερμόν ἐστιν, ἔστι δ' ὡς οὔ. Ἐν μὲν γὰρ τῷ λόγῳ ὑπάρξει αὐτοῦ ἡ θερμότης, ὥσπερ ἐν τῷ τοῦ λευκοῦ ἀνθρώπου τὸ λευκόν· ᾗ δὲ κατὰ πάθος τὸ αἷμα, οὐ καθ' αὑτὸ θερμόν, *Part. An.* II.3, 649b.2l–27.

115. On Aristotle's queer expression ὅ ποτε ὂν ἐστιν, see Lederman (2014).

"Boiling water is hot" is, on a certain reading, contingent. It is contingent if "boiling water" is understood to mean "water that is presently boiling." For the fact that water is presently boiling does not mean that it always will or necessarily must boil: Water that is presently boiling can cool and might never have been heated. To be sure, even on this reading we may truly assert a *de dicto* necessity: It is necessary that, if something is a sample of water that is presently boiling, then it is presently hot. But it is not necessarily true *of this sample of water* that it is boiling.

Yet there is another reading, Aristotle maintains, on which this predication is necessarily true in the sense of a *per se* predication. To make a statement about "boiling water" used in the former way is to make a statement about something *qua* water, adding that the water under consideration is presently boiling. But we may also treat "boiling water" as a unit, and take the sentence "boiling water is hot" to be a statement about anything *in so far as* it is boiling water. In this case, Aristotle says, it is "as if we gave a special name to boiling water."

To see how this works, let us call water that is boiling "bowater." That is, something counts as a sample of "bowater" if, and only if, (i) it is water, and (ii) it is boiling. "Bowater is boiling" is then a *per se* necessity in Aristotle's first sense, because "boiling" is part of the definition of "bowater." "Bowater is hot" is plausibly a *per se* necessity in Aristotle's fourth sense, under the assumption that being heated is definitionally true of being boiling. In that case, given a sample of bowater, it will always be true to say that it is boiling; for a sample of water only counts as a sample of bowater *if* it is boiling. When the water cools, "bowater is boiling" does not cease to be to be true, because the cool water is not a sample of bowater. The water is not identical with bowater, but the "substrate" of bowater. Thus the comparison of a time when water is boiling and water has cooled does not constitute a witness to a change from boiling to non-boiling of bowater, because after it has cooled, no sample of *bowater* is present. The cooling of the water is the perishing of the bowater.

The existence of water that is not boiling has consequently no bearing on the truth of the statement that all bowater is necessarily boiling.

The inherence of "boiling" in the definition of "bowater" thus generates not only the *de dicto* necessity (necessarily, anything that is bowater is boiling) but also a *de re* necessity (it is necessairly true of anything that is bowater that it is boiling). The latter is true because a sample being bowater here and now implies that it only exists at those times when it is still boiling and thus hot. Thus, whenever bowater exists, it is boiling. In this sense it is necessary that bowater boils.

Aristotle claims that the term "blood" in the sentence "blood is hot" is ambiguous in the same way as the term "boiling water." It may be taken to denote the underlying matter which, when hot, constitutes blood, or it may be understood as a special name given to this matter at those times when it is hot. We might thus disambiguate between the blood substrate (the underlying stuff that must be heated to serve as blood in a living animal) and blood proper (this stuff so heated, able to serve its function as blood), both of which may be denoted by the term "blood."[116]

Aristotle calls the use of "blood" to denote blood substrate its usage "as an affection."[117] In this sense, the word "blood" functions like the term "pale" when used to denote a pale person: The expression "the pale thing" adverts to a further, underlying subject that may *cease* to be pale. On this reading, it is not necessarily true to say that "the pale thing is pale," since "the pale" is simply a way of referring, by way of its present paleness, to something that need not be pale in order to exist. Likewise, in the case where blood is used "as an affection," Aristotle holds that it is not necessary in the sense of a *per se* predication that blood is hot, because "blood" designates the underlying matter of blood, and it is not always true that this matter is hot. But if it is taken to refer to blood *proper*,

116. Cf. *Meteor.* IV.11, 389b.8–15.

117. κατὰ πάθος, *Part. An.* II.3, 649b.27 (T39).

then it designates what Aristotle calls a "coupled entity."[118] A coupled entity is a thing defined in such a way that it only exists when some other thing has some property.[119] In this case, blood proper is a coupled entity because its existence requires not only the existence of the matter of blood but also this matter's being in the appropriate condition to serve its biological function. If "blood" is understood this way, then it is always true to say that blood is hot, because used in this way "blood" only has reference when the substrate of the blood is heated. Thus the claim that blood is hot is true *by definition*, since blood proper just is heated blood-substrate. The fact that there are times when blood is not hot do not contradict the claim "blood is necessarily hot" with "blood" taken in this sense any more than the existence of times when water is not boiling contradict the claim that bowater is necessarily boiling. In both cases, the existence of the subject guarantees the inherence of the predicate in it.

Far from being an ad-hoc solution to a problem about blood, Aristotle indicates that he takes this idea to have broad application. He entertains the possibility that even terms for the physical elements may display this type of ambiguity:

> **T40** Maybe even the nature of fire might turn out to be like this. Perhaps the substrate is smoke or charcoal, of which the former is always hot (for smoke is an exhaust), whereas charcoal, when extinguished, is cold.[120]

Here Aristotle takes the real nature of fire to be an open scientific question, and entertains the possibility that even it, an elemental kind, might turn out to display the ambiguity of the term "blood." Depending on what the substrate turns out to be, Aristotle explains, it may or may not be the case that "fire" suffers the same ambiguity. If it turns

118. συνδυαζόμενον, *Part. An.* II.2, 649a.15.

119. On coupled entities see further Lewis (1991) and Matthews (1982).

120. Τάχα δὲ καὶ ἡ τοῦ πυρὸς φύσις, εἰ ἔτυχε, τοιαύτη τίς ἐστιν· ἴσως γὰρ τὸ ὑποκείμενόν ἐστιν ἢ καπνὸς ἢ ἄνθραξ, ὧν τὸ μὲν ἀεὶ θερμόν (ἀναθυμίασις γὰρ ὁ καπνός), ὁ δ' ἄνθραξ ἀποσβεσθεὶς ψυχρός, *Part. An.* II.2, 649a.20–23.

out that the underlying substrate of fire is smoke, then Aristotle holds that there it will not be possible (on any reading) for fire to fail to be hot, since smoke is itself necessarily hot, being an exhaust, and so there is no way that the substrate of fire could cease to be hot. Thus, even if "fire" is taken to denote its substrate, it will still necessarily be hot. But if the underlying substrate of fire turns out to be charcoal, then there will be a sense in which it is *not* necessary that fire is hot: For if fire turns out to refer to charcoal in a special condition, then to speak of fire is, in one sense, just to speak of charcoal "according to an affection."[121] Since burning charcoal can be extinguished, it is possible for fire to become cool, if "fire" is understood to refer to this substrate. Nevertheless, there will be another sense – the sense in which fire is spoken of like a name for boiling water – in which it will be no counterexample to fire's being hot that charcoal can be extinguished.

This illustrates the way in which there can be *per se* necessities involving perishable individuals. We must distinguish between two types of case. There are, firstly, cases like fire, under the assumption that the substrate of fire is smoke. In this case, it will be a true *de re* necessity to say that fire is hot, since smoke dissipates when it is cooled, and so the substrate of fire is itself hot whenever it exists. This reflects the fact that all fire is necessarily hot, which in turn reflects the fact that heat is a *per se* predicate of fire. In other cases, an entity may consist of a substrate in a certain condition, where the substrate is able to exist without being in that condition. In this case, a *de re* necessity will still obtain, so long as the subject of the predication is understood to designate the substrate *when* it is in the appropriate condition. Thus, blood is necessarily hot so long as "blood" is understood to refer to blood proper, the coupled entity that exists only when the matter or substrate of blood is able to serve its biological function. Since coupled entities are *defined* in such a way that they exists only when their underlying substrate satisfies the account associated with the predicate term, the times when the substrate fails to satisfy this term

121. κατὰ πάθος, *Part. An.* II.3, 649b.27 (T39).

do not contradict the omnitemporal truth of the predication. Even a perishable entity like blood may in this way be the subject of a *per se* necessity so long as it is understood to refer to the coupled entity, which cannot exist unheated, rather than the underlying substrate, which can.

### *3.4.2 Necessities like the eclipse of the moon:* Posterior Analytics *I.8*

This takes care of one type of case where the impermanence of a subject seems to contradict the eternal truth of a scientific predication. But there is another type of case, exemplified by the lunar eclipse. Aristotle takes it to be a scientific predication that eclipse holds of the moon. Yet it is not *always* the case that the moon is eclipsed. The problem here is not, as above, that instances of the subject kind may perish and thus lose their definitional properties: The moon is the only thing of its kind, and it exists, Aristotle holds, eternally.[122] The problem is rather the converse. The moon, even though it always exists, is not always eclipsed. That is, even though the subject term always applies to its instances (or, in this case, its sole instance), these instances do not always fall under the predicate term. And yet Aristotle wishes to maintain that it is a task of science to explain by demonstration why the moon suffers eclipse.

Aristotle discusses this problem in *Posterior Analytics* I.8, where he adopts the terminology of a demonstration "simpliciter" for one proceeding from premises that are "universal" in the sense above:[123] Premises that are *per se* and hold "of all" of their subjects. It follows that there is no demonstration "simpliciter" of states of affairs that are "perishable" in the sense that they could change their truth-value:[124] Any demonstration with premises that are necessary in the sense of being "universal" has a conclusion that is likewise universal

122. *Met.* Z.15, 1040a.28–29.

123. *Post. An.* I.8, 75b.21–23. Cf. *Post. An.* II.2, 90a.16–18, *Post. An.* II.8, 93a.30–31, 36–39.

124. *Post. An.* I.8 75b.24–25.

and thus eternally true, not merely "at some time and in some way."[125] But Aristotle moves to forestall the impression that this implies that demonstrations can only be given of predicates that apply to their subjects invariably or for all time. There are also demonstrations of attributes that apply to their subjects "repeatedly"[126] like a (lunar) eclipse. It is not *eternally true* that the moon is eclipsed; sometimes the moon is unobscured by the earth. Nevertheless, there is a sense in which this fact and its demonstration hold eternally:

> **T41** With demonstrations and knowledge of things that occur repeatedly, like the eclipse of the moon, it is clear that they are eternal in so far as the they are of this sort, and in so far as they are not always, they are in part.[127]

Aristotle's explanation is cryptic, but the semantic theory outlined above makes it easier to understand his point. Aristotle distinguishes two necessities associated with the eclipse of the moon. On the one hand, we may consider things like the moon "in so far as the they are of this sort."[128] What Aristotle means by this is that we may consider the moon just at those times when it undergoes the cause of being eclipsed, that is, when it suffers a deprivation of light due to the interposition of the earth. Thus, while it is not the case that *the moon* is always eclipsed, it is the case that *the moon when suffering a deprivation of light due to an interposition of the earth* is *always* eclipsed.[129] To consider the moon in this way is to speak about a certain "coupled entity" like hot-blood: Something that exists only when the moon exists and suffers this cause. Although Aristotle does not claim here that the term "moon" is ambiguous like "blood," in such a way to allow this as a possible sense of

125. ποτὲ καὶ πώς, *Post. An.* I.8, 75b.26.

126. πολλάκις, 75b.30.

127. αἱ δὲ τῶν πολλάκις γινομένων ἀποδείξεις καὶ ἐπιστῆμαι, οἷον σελήνης ἐκλείψεως, δῆλον ὅτι ᾗ μὲν τοιαίδ' εἰσίν, ἀεὶ εἰσίν, ᾗ δ' οὐκ ἀεί, κατὰ μέρος εἰσίν, *Post. An.* I.8, 75b.33–35. Reading τοιαίδ' with C for the OCT's τοιοῦδ', following Barnes.

128. ᾗ μὲν τοιαίδ' εἰσίν, *Post. An.* I.8, 75b.34 (T41).

129. Cf. *Post. An.* II.12, 95a.22–24.

"moon," he nevertheless claims that it is this associated coupled entity that *always* suffers eclipse and in this sense features as the subject of the necessity. The coupled entity consists of the moon and the causal property responsible for it being eclipsed – in this case, its deprivation of light owing to the earth's shadow. Whereas the moon is not always eclipsed, this coupled entity always is eclipsed whenever it exists, since even though the *moon* can exist without being shadowed by the earth, the moon-when-shadowed-by-the-earth never exists uneclipsed. It is an eternal truth that the moon-when-shadowed-by-the-earth is eclipsed even though it is not an eternal truth that the moon is eclipsed.

This is one of the necessities associated with an intermittent phenomenon like the lunar eclipse that it is the task of a scientist to understand. This is not trivial: It tells us that it is the *moon* that is necessarily the underlying subject of lunar eclipses, and that the cause expressed in a demonstration or complete definition is *sufficient* for the moon to suffer a lunar eclipse. Aristotle however also goes on to mention a *second* necessity that may be associated with the eclipse of the moon in the last few words of the passage, where he writes that "in so far as they are not always, they are in part." In order to see what Aristotle means by this, we must notice that "lunar eclipse" predicated of "moon" fits his definition of a *per se*$_2$ predication. "Moon," the subject of this predication, figures in the definition of the predicate, "lunar eclipse" by revealing its primary subject. A lunar eclipse is a deprivation of *the moon's* light owing to the interposition of the earth. It follows, according to the reading I provided above, that a *particular* necessity proposition holds. Aristotle, of course, cannot mean that *some* moons are necessarily eclipsed, since there is only one moon and it is not always eclipsed. Instead, in the case of a repeatable phenomenon like a lunar eclipse, Aristotle takes the relevant *instances* to be the moon considered at certain times. His claim is that the moon is necessarily eclipsed *at some times*. This follows, on Aristotle's analysis, from the fact that lunar eclipse holds of the moon as a *per se* predicate in the second sense, where "moon" is understood as a general term encompassing the moon

at all possible times.

Aristotle concludes this chapter with the remark: "Just as for eclipse, so too for other cases."[130] Thus Aristotle intends this account to extend to all demonstrations in which the explanandum is a general, repeatable phenomenon but not one which holds of its subject at all times. Here Aristotle probably intends to refer to other demonstrations of repeatable phenomena he describes, such as:

1. Thunder holds of fire being extinguished,
2. Fire being extinguished holds of a cloud,
3. Therefore, thunder holds of a cloud.[131]

1. Leaf-shedding holds of sap coagulating at the stem,
2. Sap coagulating at the stem holds of broad-leaved plants,
3. Therefore, leaf-shedding holds of broad-leaved plants.[132]

In both premises of these demonstrations, the subject forms a part of the essence of the predicate: For something to be an instance of thunder is, in part, for it to be a certain type of noise of extinguishing fire; part of what it is for leaves to shed is for sap to coagulate at their stem. The second premise does so by locating the predicate in the broadest subject to which it belongs: Thunder is the type of noise of fire being extinguished that takes place *in a cloud*, leaf-shedding is the effect of coagulation of sap at the stem when this occurs in *broad-leaved plants*, etc.[133] This makes both premises *per se* predications in the second sense according to the definition given in T31. The middle term articulates the causal factor (fire being extinguished, sap coagulation at the stem) that serves to explain the

130. ὥσπερ δ' ἡ ἔκλειψις, ὡσαύτως τοῖς ἄλλοις, *Post. An.* I.8, 75b.35–36.

131. *Post. An.* II.8, 93b.9–11.

132. *Post. An.* II.16, 98b.1–16. One could also include the flooding of the river Nile at *Post. An.* II.15, 98a.30–34.

133. *Post. An.* II.8, 93b.11. Cf. Bronstein (2016, 39–40) and Lennox (1987, 93).

connection between the two extreme wholes. The demonstration as a whole articulates the full definition of the predicate of the major premise: An eclipse is the deprivation of light in the moon on account of the imposition of the earth, leaf-shedding is the coagulation of sap at the stem of broad-leaved plants.[134]

Yet while they are for this reason *per se*, none of these premises express predications that hold of all of their subjects. It is not the case that every cloud is always thundering, nor is it the case that the moon is always eclipsed, nor the case that broad-leaved plants are always and everywhere shedding their leaves. The necessity of demonstrative premises is more plausibly located in the three conditions that we extracted from Aristotle's discussion of the necessity of *per se*$_2$ predication. First, (i) anything possessing the property expressed by the predicate term must be something of the subject kind: Any leaf-shedding is a coagulation of sap, and coagulation of sap is the sort of process that requires plants with a broad leaf. That is, the subject holds "of all" of the predicate term. Second, (ii) there is necessarily *some* sub-kind of the subject that necessarily does have that property. That is to say, given that thunder is the sort of process to take place in a cloud, there is necessarily such a thing as a thundering cloud, and likewise there is such a thing as an eclipsed moon, and a broad-leaved plant shedding its leaves. Finally, while Aristotle does not draw attention to the fact, it is plausible that (iii) holds of these as well: any time the moon is not eclipsed it is exposed; any broad-leaved plant that is not shedding its leaves is retaining them, etc.

Yet in addition to presenting general explanations of phenomena like thunder and leaf-shedding, the demonstrations above may also be interpreted as the application of such general phenomena in particular instances. That is, in addition to giving a description of how *eclipses* or *thunder* takes place, demonstrations of this type may also be interpreted as a description of why some particular cloud under discussion is presently thundering, or why

134. See *Post. An.* II.93b.39–94a.10.

a particular vine is shedding its leaves at this time of year. The explanandum expressed in the conclusion is then not the general fact that clouds thunder or that broad-leaved plants lose their leaves, but the fact that a particular cloud is thundering or that a particular plant is shedding its leaves. *Post. An.* I.8 outlines a way to understand these demonstrations as nevertheless describing *de re* necessities even under this interpretation. Aristotle tells us that we may still interpret the conclusions as necessities if we understand the subject term to denote a coupled entity consisting of the minor term in the condition described by the middle: A cloud-when-fire-is-extinguished-in-it, a plant-with-coagulating-sap. It is a *de re* necessary property of these individuals that they have the property expressed by the major term (thundering, leaf-shedding), since the middle term precisely describes what is responsible for the presence of the major term in the subject. Thus, so long as the cloud-when-fire-is-extinguished-in-it exists, it *must* be thundering, and so long as the plant-with-coagulating-sap exists, it *must* be shedding its leaves.

## 3.5 Conclusion: *Per se* necessity as an alternative to the Forms

To conclude this chapter, let us return to the points with which we began. Aristotle takes himself to share with the proponents of the Forms the view that knowledge must have a stable object, and he agrees with them that this object cannot be a sensible particular. But he levies two charges against the proponents of Forms, broadly under the banner of their "idleness." Aristotle's first complaint is that, by invoking the $F$-Itself, they fail to give an account of our knowledge of $F$s, since they conceive of the $F$-Itself as a further, non-$F$ individual bearing no causal or predicative relationship to any of the $F$s despite being called the "$F$." Second, and more powerfully, Aristotle argues that a theory of the Forms, at least where Forms are conceived of as individuals, fails even to explain how we know the Forms themselves, and thus how we know anything (since, on this account, Forms were supposed to be the sole objects of knowledge). If scientific knowledge requires

definition, and the Forms are indefinable, then Forms do nothing to contribute to a theory of scientific knowledge.

Aristotle's account of *per se* predication avoids these problems with the theory of the Forms. Rather than positing additional individuals to serve as the appropriate subjects for stable truths, Aristotle instead gives a theory of definitional truth and definitional necessity directly. He constructs his theory in such a way that kinds with perishable instances and even perishable individuals can have definitionally necessary properties. Humans are necessarily animals in the sense that a human cannot exist without being an animal, not in the sense that a human always exists and is an animal. Likewise a particular human may be said to be necessarily an animal in so far as that human could not exist without being an animal.

A close examination of Aristotle's conception of *per se* predication thus shows that this sense of necessity does not require sciences to be limited only to certain kinds, like mathematical kinds, nor does it rule out scientific knowledge concerning individuals. It only rules out scientific knowledge of individuals *as such*. Any knowledge of an individual must rely on general facts that may be proven about its kind. What underwrites scientific necessities for Aristotle generally is not that they pertain to special subjects that are always in the same condition, but rather that they identify connections between phenomena or things and their properties that cannot fail to hold given what each of them consists in. Mathematics is a convenient stock of examples for Aristotle, but not a special case as far as the modal status of its claims is concerned.

Three important issues remain unresolved, however. First, while I have explained in this chapter how definitional truths underwrite necessity, for Aristotle, I have not said much about what makes something a definitional truth for him. To do so is the task of the next chapter. Second, although Aristotle claims that all premises of demonstrations are *per se* truths, he also talks of a number of other kinds of demonstrative principles that

do not seem to be of this kind. I will say something about how these fit into the picture sketched here in the next chapter as well. Third, the fact that Aristotle takes both natural scientific truths and mathematical truths to be *per se* necessities should not be understood to imply that Aristotle sees no pertinent differences in the type of necessity that pertains to empirical and non-empirical sciences, or in the way that necessity is grounded in the respective cases. A specification of the *differences* between the types of necessities that pertains to empirical and non-empirical sciences will be the task of the fifth and final chapter.

# CHAPTER 4

# THE SOURCE OF DEMONSTRATIVE NECESSITY

In the previous chapter, I explored what Aristotle takes the object of knowledge to be: What it is that we may be said to know, given that knowledge is of something necessary. I argued that Aristotle resists the stipulation of supramundane individuals, and articulates a series of types of necessity that apply to the familiar objects of our experience, both at a general level, and, derivatively, at the level of particulars.

In the course of that study, I claimed that Aristotle takes demonstrative necessities to be true *per se*, that is, in virtue of a definitional connection (immediate or mediate) between the premises and conclusions. In this chapter, my object is to deepen our understanding of what these *per se* necessities consist in, by asking what makes a certain connection between terms a definitional one, for Aristotle, and thus what makes a *per se* necessity a necessity.

In asking this question, we are asking on Aristotle's behalf what contemporary philosophers would call a *demarcation problem*. This is the problem of saying what it is that makes members of a certain class members of that class, and, conversely, what excludes non-members. The demarcation problem for the class of necessary truths as a whole has been discussed at length in the contemporary literature.[1] This is the problem of saying what makes it the case that a given truth is necessary rather than contingent, or, equivalently, of explaining why certain necessary truths are necessary. For instance, what makes it the case that a truth like 2+2=4 holds of necessity, while another truth, that there are

1. See Dummett (1959), Armstrong (1989), Platinga (1974, esp. 27–43 and 70–87), Lowe (2013, 139–62), Cameron (2010), and Chalmers (2012) and Hale (2002). Sanyal (2015, 74–131) gives a useful overview of the main types of positions that have been defended since David Lewis. I take it that Lewis himself would reject this question as misguided, since he thinks that the correctness of the standard semantics for modal logic may be explained by saying that they capture primitive metaphysical relations among the possible worlds (see Lewis 1986, 7–8, 17–20). Blackburn (1993) also doubts the possibility of such an answer, but for rather different reasons: He takes any attempted reduction of the modal to the non-modal to be question-begging.

six books currently on my desk, does not.

In this chapter, I aim to show that Aristotle has a demarcating criterion not for the class of necessary truths as such, but for a certain class of necessary truths, the necessities that figure in scientific demonstrations.[2] Aristotle holds that demonstrable truths have a necessity that is parasitic on that of their premises; such a truth is necessary *because* the principles that figure in its demonstration are necessary. The necessity of the principles themselves is given a different type of explanation. Aristotle explains their necessity in terms of their *simplicity*. Simplicity thus provides the fundamental explanation for the necessity of demonstrative truths, explaining the necessity of first principles directly, and mediately explaining the necessity of demonstrable truths.

## 4.1 The structure of Aristotle's answer: *Metaphysics* Δ.5

The core of Aristotle's answer to the demarcation problem for demonstrative necessity comes, perhaps surprisingly, in *Metaphysics* Δ.5, a chapter devoted to delineating the various senses of "necessary" and the semantic relationships they bear to one another. Aristotle first distinguishes the senses of "necessary" in which we say that something is a necessity of life (like food)[3] or for some end (the example given is sailing to Aegina to

2. Does Aristotle recognize any other necessities besides these? If not, then Aristotle's answer to the demarcation problem for demonstrative necessities will also constitute an answer to the demarcation problem for the class of necessities as a whole. However, it is not clear whether Aristotle would accept the claim that all necessities occur as the conclusions or premises of some demonstration. I give some reasons for doubting that certain principles feature as demonstrative premises in closing. Further, it may be questioned whether the necessity that pertains to demonstrative premises and conclusions is the same one at issue in other contexts, especially the conditional necessities Aristotle makes central to natural science in *Parts of Animals* I.1 (639b.21–640a.1), and the "cyclical" necessities described in *De Generatione et Corruptione* II.11 (cf. 337b.14–338a.16). I will leave aside these questions here and argue only that Aristotle provides an explanation for the necessity of demonstrative premises and conclusions. On this see further Sorabji (1980, 222–24).

3. *Met.* Δ.5, 1015a.20.

receive goods),[4] and necessity in the sense of "compulsion" (what "obstructs and thwarts in the presence of inclination or choice").[5] After distinguishing these special senses, Aristotle goes on to specify the sense of necessity "from which all the other senses are derived."[6] This core sense[7] of necessity is "being incapable of being otherwise."[8] All of the other senses of necessity can be understood, Aristotle claims, as something being incapable of being otherwise, broadly construed. In particular, Aristotle specifies, this is the sense of necessity that also characterizes the conclusions of demonstrations, since "if something is demonstrated unqualifiedly, it cannot be otherwise."[9] He then explains *why* the conclusions of unqualified demonstrations cannot be otherwise, as follows:

> **T42** The reason for this [sc., for the necessity of the conclusions of demonstrations] is the primary things, since those things which the syllogism is from [sc., its premises] cannot be otherwise.[10]

The necessity of demonstrative conclusions, Aristotle holds, is derivative. It is explained by the necessity of the "primary things", a term Aristotle equates with "first principle" when he introduces the concept of a principle of demonstration in the *Posterior Analytics*.[11] Aristotle does not here spell out how the necessity of the "primary things" explains the

4. *Met.* Δ.5, 1015a.25. I discuss these two types of necessity in the next chapter: See section 5.2.

5. τὸ παρὰ τὴν ὁρμὴν καὶ τὴν προαίρεσιν ἐμποδίζον καὶ κωλυτικόν, *Met.* Δ.5, 1015a.26–27.

6. κατὰ τοῦτο τὸ ἀναγκαῖον καὶ τἆλλα λέγεταί πως ἅπαντα ἀναγκαῖα, *Met.* Δ.5, 1015a.35–36.

7. On Aristotle's way of analyzing the meaning of a term into a core meaning on which other meanings depend, see Shields (1999).

8. τὸ μὴ ἐνδεχόμενον ἄλλως ἔχειν, *Met.* Δ.5, 1015a.34.

9. οὐκ ἐνδέχεται ἄλλως ἔχειν, εἰ ἀποδέδεικται ἁπλῶς, *Met.* Δ.5, 1015a.6–9. On Aristotle's distinction between qualified and unqualified demonstration, see *Post. An.* I.8, 75b.21–30.

10. τούτου δ' αἴτια τὰ πρῶτα, εἰ ἀδύνατον ἄλλως ἔχειν ἐξ ὧν ὁ συλλογισμός, *Met.* Δ.5, 1015b.8–9.

11. ταὐτὸ γὰρ λέγω πρῶτον καὶ ἀρχήν, *Post. An.* I.2, 72a.6–7; cf. 74b.24–25, 76a.28–30.

necessity of demonstrative conclusions, but under the assumption that he is using "primary thing" in the sense of "first principle", we can surmise the argument he intends. First principles serve, in Aristotle's theory of demonstration, as the ultimate premises of chains of demonstrative proofs.[12] Since a demonstration is a deductive argument,[13] if the premises of demonstrations are themselves necessities, all demonstrable truths are deducible from necessary truths. Tacitly relying on the principle that anything which follows by necessity from necessary premises is itself a necessary truth,[14] Aristotle infers that the conclusions of demonstrations are themselves necessities.

Aristotle offers this argument not just as an argument for the necessity of demonstrative conclusions, but as an explanation[15] for why the conclusions of demonstrations are necessary. He holds that the fundamental reason for the necessity of a demonstrable truth is the necessity of first principles from which that truth can be demonstrated.[16] There

12. Sometimes Aristotle will speak of demonstration in a way that suggests or implies that only arguments directly from first principles count as demonstrations (71b.26–27, 72a.37–72b.3, 74a.25–30, 75b.37–8, 76a.14–15). In other places, he appears to think of demonstrations as forming chains of deductions that bottom out in first principles (72b.20–22, 79a.29–31, 81b.14–18, 83b.38–84a.1). The problem is terminological, not philosophical. Generally, in the contexts where Aristotle is discussing the properties of premises of demonstrations, he uses "demonstration" to refer to a deduction from the ultimate premises of the science. Such arguments may contain a number of deductive steps. In the latter contexts, where he is more interested in the structure of demonstrations themselves or a demonstrative science as a whole, he uses "demonstration" in a more restrictive way to refer to a syllogism with three terms only containing a single deductive step. A demonstration in the less restrictive sense is a chain of demonstrations in the more restrictive sense. The claim that demonstrations are from "primary things" or from predications that are *per se* in one of the first two senses should be understood to apply to demonstrations in the more restrictive sense only.

13. *Post. An.* I.2, 71b.17–18. On the broad sense of συλλογισμός as "deductive argument," see Barnes (1981).

14. The principle is articulated at *Pr. An.* I.15, 34a.23–24.

15. αἴτια, *Met.* Δ.5, 1015b.8.

16. This explanation depends on every demonstrable truth having one and only one demonstration, something which Aristotle endorses, albeit with some ambivalence: See *Post. An.* I.29, II.16–18.

would be the threat of a regress if Aristotle required the necessity of first principles likewise to be explained by the necessity of still more basic truths, since then we could ask what further necessary truth explains the necessity of these, and so on. Aristotle forestalls the threat of regress by distinguishing two forms that the explanation of a truth's necessity may take:

> **T43** For some things, the reason for their being necessary is something else, but for others there is nothing else; rather, other things hold of necessity on account of *them*.[17]

The type of structure that Aristotle has just presented in explaining the necessity of demonstrated truths on the basis of the necessity of principles exemplifies the first type of explanation he delineates here, an explanation of one necessity by recourse to "something else:" The necessity of demonstrable truths is explained in terms of the necessity of first principles. But for other necessities, there is no other item whose necessity we advert to in explaining their necessity. These necessities ground other necessities without their necessity being grounded in the necessity of anything "else."

Although Aristotle does not say so explicitly, at least some first principles must belong to this second class of necessities if the distinction between two types of explanation is to forestall a regress, since he has already claimed that the necessity of all demonstrable truths is derivative, and first principles make up the remainder of demonstrative truths. First principles must therefore include truths whose necessity is not explained by any more fundamental necessity. The metaphysical picture of demonstrative necessity is thus foundationalist in character. (Some) first principles have no "other" explanation for their necessity. They make up the metaphysical basis of demonstrative necessities, explaining but not being explained by any further demonstrative necessities.[18]

17. τῶν μὲν δὴ ἕτερον αἴτιον τοῦ ἀναγκαῖα εἶναι, τῶν δὲ οὐδέν, ἀλλὰ διὰ ταῦτα ἕτερά ἐστιν ἐξ ἀνάγκης, *Met.* Δ.5, 1015b.9–11.

18. For a similar reading, see Asclepius *in Met.* 313.14–18.

This should not, however, be taken to imply that the necessity of these first principles is inexplicable. The claim is that their necessity has no "other" explanation, not that it has no explanation at all.[19] Given that, in the contrasting case of demonstrable necessities, the "other" thing that explains their necessity is the necessity of a different truth (a demonstrative premise), it is natural to interpret the claim that first principles have no "other" explanation as meaning that the ground of their necessity is not some other necessary truth.

This is important, since it shows that Aristotle is both sensitive to the demarcation problem for necessities and sees what a successful solution requires. Unlike most contemporary theorists, however, his approach is not to explain the necessity of *all* necessary facts directly by way of some feature that all necessities share, such as analyticity or a priority.[20] Instead, he allows that some necessities are explained in a derivative way by recourse to what necessitates them, but ensures that his explanation is well-founded by positing that certain, foundational necessities are to be explained in a fundamentally different way, one that does not rely on other necessary truths transmitting their necessity to them.[21]

Aristotle goes on to tell us what grounds the necessity of the first principles:

19. *Contra* Aquinas *in Met.* §839. In other words, it is important that we supply ἕτερον ("other") after οὐδέν ("no" or "none") at 1015b.10: Aristotle is not saying that certain necessities are *groundlessly* necessary; he is saying that certain necessities have no "other" explanation. I take this to mean that certain truths do not have their necessity imparted to them by any other truth; instead, it is some feature of their own truth that makes them necessary. Deslauriers (2007, 55–65) provides a careful argument that Aristotle's talk of having "no other cause" (in a different context) is not to be equated with having *no* cause. I discuss this further below. See also Goldin (1996, 105–30) and Charles (2000, 202).

20. As in Chalmers (2012). Blackburn (1993, 120–1) presents this as the approach of most philosophers who seek to answer the demarcation problem but rejects it himself. A contemporary approach close to Aristotle's is Hale (2002).

21. Aristotle's view of demonstrable necessities is thus what Hale (2002, 309) calls a "*transmission-model*" (his emphasis).

**T44** the primary and governing necessity is the simple. For this is not capable of being in multiple ways, and so it cannot be one way and another: For then it would already be in multiple ways.[22]

First principles are necessary on account of "the simple."[23] This makes "the simple" the "primary and governing necessity."[24] In making this judgment, Aristotle is not retracting his statement lines above that the core sense of necessity is being "incapable of being otherwise."[25] To be the governing sense of a term is not the same as being its core meaning. In saying that being "incapable of being otherwise" is the core sense of necessity, Aristotle was saying that it is the sense which runs through all of the other senses of necessity, the broad sense that encompasses each of the specific meanings. Each of the other senses of necessity is a matter of something in some sense being "incapable of being otherwise."[26] On the other hand, by saying that "the simple" is the "governing" and "primary" necessity, Aristotle is saying the simple is the most fundamental necessity. It is the "primary"[27] necessity because there is no more fundamental necessity that explains its necessity. And it is the "governing"[28] necessity because it grounds the necessity of all other truths which occur in demonstrations.[29] It is because the first principles are necessary that no demonstrated fact can be otherwise, and it is because of the "the simple" that first principles themselves are necessary.

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22. τὸ πρῶτον καὶ κυρίως ἀναγκαῖον τὸ ἁπλοῦν ἐστίν· τοῦτο γὰρ οὐκ ἐνδέχεται πλεοναχῶς ἔχειν, ὥστ' οὐδὲ ἄλλως καὶ ἄλλως· ἤδη γὰρ πλεοναχῶς ἂν ἔχοι, *Met.* Δ.5, 1015b.11–14.

23. τὸ ἁπλοῦν, *Met.* Δ.5, 1015b.12.

24. τὸ πρῶτον καὶ κυρίως ἀναγκαῖον, *Met.* Δ.5, 1015b.11–12.

25. *Met.* Δ.5, 1015a.33–36.

26. Presumably with necessity in the sense of force the idea is that something cannot by volition do other than it is forced to. I discuss the first two senses of necessity in the next chapter.

27. πρῶτον, *Met.* Δ.5, 1015b.11.

28. κυρίως, *Met.* Δ.5, 1015b.12.

29. For this usage of κυρίως, see *De An.* II.7, 418a.24 and *Nic. Eth.* VIII.5, 1157a.31.

But what does Aristotle mean by "the simple," and in what sense is it supposed to be necessary? Broadly, there are two types of readings one might take. On one reading, "the simple" refers to a certain type of *object*. These objects are "necessary" in that they *exist* necessarily. Aristotle's claim, on this reading, is that the existence of these simple beings is what makes the principles of demonstrations, and through them demonstrative conclusions, hold of necessity.[30] On another reading, Aristotle is using "the simple" to refer to a certain type of predication or truth. He is saying that first principles are truths of a "simple" kind, and this makes them, and through them all other demonstrative truths, hold of necessity.[31]

Aristotle's ensuing explanation of how the simple is necessary does not resolve this issue. Aristotle explains that the simple is necessary because it cannot be "in one way and another," since it would then be "in multiple ways." On the existential reading, Aristotle's claim here is that a simple being exists only ever in one condition, since being capable of existing in multiple conditions (being "one way and another") would undermine its simplicity. On the predicative reading, his point is rather that a "simple" predication always has the same truth value. A simple truth is not like the statement that Socrates is sitting, which, as we have seen, may be at one time true, and at another time false. Being such would require it to possess a type of predicative complexity that it lacks on account of its simplicity.

On either reading, Aristotle provides an explanation for the necessity of first principles

30. Cf. Hale (2013) for a discussion of the prospects of this type of approach to the demarcation problem about necessity.

31. Bolton (1997, 118) appears to take ἁπλοῦν this way, translating 1015b.11–12 as "what is primitive and strictly necessary is undifferentiated." On his reading, Aristotle is not identifying the primary and governing sense of necessity with a simple (type of) object, but rather only attributing simplicity to it. Aquinas, on the other hand, takes Aristotle to be inferring the existence of a "single, first necessary being, from which other things derive their necessity" (*unum primum necessarium, a quo alia necessitatem habent*, Aquinas *in Met.* §840).

that avoids a regress in his account of the source of demonstrative necessities. For on neither reading do we explain the necessity of first principles by recourse to any more fundamental necessary truth. On the first reading, the necessity of first principles is explained by the existence of simple beings. The existence of these grounds the necessary truth of first principles. On the alternative reading, the necessity of first principles is explained by the type of truths that they are. The first principles are necessary because they are simple, not because of some other, more fundamental necessary truth. The positions expressed by these two readings are compatible: One could hold that certain first principles express a special, simple type of necessary truth, and that they do so because of the types of objects they describe. In fact, we will see, this is roughly Aristotle's view.

There remains the issue, however, of what Aristotle means by "the simple" in T44. Aristotle explicitly describes the principles of demonstrations as simple in *Posterior Analytics* I.23:

> **T45** just as in the other cases, the principle is simple, but it is not the same everywhere; rather, in weight it is the mina, in music, the semitone, and so on in other cases. And so too in a syllogism it is the unitary immediate premise[32]

Demonstrative principles stand to demonstrative conclusions, Aristotle claims here, as a unit of weight stands to a quantity of weight, or as a "semitone" stands to a musical score. He compares the immediate syllogistic propositions that form the ultimate premises of demonstrations with a unit of weight or the smallest interval on which harmonies are built. All of these, he says, are "simple principles" in their respective domains. So Aristotle does take the first principles to be "simple," and we may infer that he takes them to be a simple kind of predication or truth, since he is explicitly talking about a demonstrative

32. ὥσπερ ἐν τοῖς ἄλλοις ἡ ἀρχὴ ἁπλοῦν, τοῦτο δ' οὐ ταὐτὸ πανταχοῦ, ἀλλ' ἐν βάρει μὲν μνᾶ, ἐν δὲ μέλει δίεσις, ἄλλο δ' ἐν ἄλλῳ, οὕτως ἐν συλλογισμῷ τὸ ἓν πρότασις ἄμεσος, *Post. An.* I.23, 84b.37–85a.1.

"principle" in the sense of a syllogistic premise here.

Yet that does not show that Aristotle is using "simple" in T44 to refer to the type of truth characteristic of first principles, because it does not rule out the possibility that he *also* uses "the simple" to refer to a special type of object. There is evidence elsewhere in the *Posterior Analytics* that Aristotle does in fact require first principles to be about a special class of object. In *Posterior Analytics* II.9, Aristotle distinguishes two classes of essential predications:

> **T46** There are some things of which there is some other cause and there are some things of which there is not. And so it is clear that also some essences are immediate and first principles, which it is necessary both to stipulate the existence of and the essence of, or to make clear in some other way (which is just what the arithmetician does: For he posits for himself both what the unit is and that it is). Those possessing a middle, i.e., those for which there is a different cause of their being, can be, as we say, made clear through demonstration without demonstrating the essence.[33]

Aristotle here draws a distinction between two classes of "essences." His talk of essence should be understood as shorthand for "essential predications," that is, the *per se*$_1$, *per se*$_2$ and *per se*$_4$ predications discussed in the previous chapter, since for him it only makes sense to describe a *statement* as having or lacking a middle term: Terms themselves do not contain middles. Echoing the language of *Metaphysics* $\Delta$.5, Aristotle draws the distinction between these two classes of definition on the basis of whether their subjects do, or do not, possess "some other cause." Only definitions of things that have no other cause are "immediates"[34] and thus fit to serve as first principles. Those which are of a subject with

33. Ἔστι δὲ τῶν μὲν ἕτερόν τι αἴτιον, τῶν δ' οὐκ ἔστιν. ὥστε δῆλον ὅτι καὶ τῶν τί ἐστι τὰ μὲν ἄμεσα καὶ ἀρχαί εἰσιν, ἃ καὶ εἶναι καὶ τί ἐστιν ὑποθέσθαι δεῖ ἢ ἄλλον τρόπον φανερὰ ποιῆσαι (ὅπερ ὁ ἀριθμητικὸς ποιεῖ· καὶ γὰρ τί ἐστι τὴν μονάδα ὑποτίθεται, καὶ ὅτι ἔστιν)· τῶν δ' ἐχόντων μέσον, καὶ ὧν ἔστι τι ἕτερον αἴτιον τῆς οὐσίας, ἔστι δι' ἀποδείξεως, ὥσπερ εἴπομεν, δηλῶσαι, μὴ τὸ τί ἐστιν ἀποδεικνύντας, *Post. An.* II.9, 93b.21–28.

34. ἄμεσα, *Post. An.* II.9, 93b.22 (T46).

"some other cause" may be represented as a syllogism,[35] but cannot themselves be first principles.

The central claim in this passage, then, is that only certain types of essential predications – only those which are "immediate" owing to their giving the essence of something with "no other cause" – make up the principles of demonstrations. I will postpone discussing how we can, on the basis of this passage and its context, further specify the class of permissible subjects for definitions that may serve as first principles. For now I wish only to note that this passage shows quite clearly that simply being an essential or definitional predication is not enough for a premise to be a possible first principle. It must be a definition or predication of the type of thing that has "no other cause." Hence, Aristotle does take there to be something special about the subjects of (at least some) first principles; and so we should leave open the interpretive possibility that "the simple" refers to the subject of a first principle in *Metaphysics* Δ.5, rather than the principle itself.

A final text that should be brought to bear here is *Metaphysics* E.4, where Aristotle explicitly raises the connection of "simples" with truth:

> **T47** Truth and falsity are not in things, as if the good were true and the bad right away false, but rather in discursive thought. But [truth and falsity] concerning simples and essences is also not in discursive thought. What is needed to theorize this kind of being and not being is to be investigated later.[36]

Although Aristotle elsewhere insists that it is things, rather than our beliefs, that

35. The reference is to the theory in the surrounding chapters of how a demonstration may set out the terms of a definition without demonstrating something's essence. See *Post. An.* II.8 and 10. See my discussion in section 4.4.1.

36. οὐ γάρ ἐστι τὸ ψεῦδος καὶ τὸ ἀληθὲς ἐν τοῖς πράγμασιν, οἷον τὸ μὲν ἀγαθὸν ἀληθὲς τὸ δὲ κακὸν εὐθὺς ψεῦδος, ἀλλ' ἐν διανοίᾳ, περὶ δὲ τὰ ἁπλᾶ καὶ τὰ τί ἐστιν οὐδ' ἐν διανοίᾳ· – ὅσα μὲν οὖν δεῖ θεωρῆσαι περὶ τὸ οὕτως ὂν καὶ μὴ ὄν, ὕστερον ἐπισκεπτέον, *Met.* E.4, 1027b.25–29.

are *responsible* for the truth and falsity of our utterances and thoughts,[37] he denies here that things in the world are properly speaking *bearers* of truth and falsity. Instead, the primary bearers of (at least some) truths and falsities are "discursive thoughts"[38] about those things. Elsewhere he clarifies that utterances may also be bearers of truth and falsity in an extended sense in so far as they express true or false thoughts.[39] But Aristotle says that the same is not so with truths "concerning simples." Here, then, the simples are not a special class of truths, but the class of things that these truths are about.[40]

Whether the "simples" are a type of truth or object in *Met.* Δ.5 cannot therefore be settled with certainty by these passages, since Aristotle is willing to call "simple" both certain types of truths (T45) and the objects these truths are about (T47). These passages also suggest that Aristotle may have a theory about how the simplicity of certain truths is related to the simplicity of the beings they concern. We can begin by following the lead of Aristotle's promise in *Metaphyiscs* E.4 to "investigate later" what is needed for a theory of being in the sense of being true and false.[41] Most commentators take this promise to

37. E.g. *Met.* Θ.10, 1051b.6–9; cf. *Cat.* 5, 4b.8–10.

38. I will return below to the issue of what Aristotle means by saying that truths concerning simples are neither in things nor in discursive thought.

39. For a detailed discussion of Aristotle's bearers of truth, which however does not take Aristotle at his word when he denies here that states of affairs are truth-bearers, see Crivelli (2004, 45–125). Unlike Crivelli, I attempt below to interpret *Metaphysics* Θ.10 as being consistent with Aristotle's claim here that truth and falsity are not in things. See further note 44 on p. 147.

40. This is the most natural way to read T47. However, this passage also may, with some strain, be read in a way that brings it into line with the alternative reading. For we could also translate the phrase rendered by "concerning simples and essences" (περὶ δὲ τὰ ἁπλᾶ καὶ τὰ τί ἐστιν) as "in connection with simples and essences" (see Smyth (1956), §1693.3.c on this broad use of περί). Aristotle could then be understood to be saying that, in the case of simple truths, these *truths* are not "in discursive thought." "Essences" could be then read as elliptical for "truths which state the essence," i.e., essential truths. On this more difficult reading, Aristotle would be using "simples" and "essences" to refer to a class of truths, rather than what these truths are about. Cf. *Post. An.* I.14, 79a.24 for this use of "essence."

41. *Met.* E.4, 1027b.28–29 (T47).

be fulfilled in *Metaphysics* Θ.10, where Aristotle distinguishes and discusses two types of truth.[42] Let us therefore turn now to the theory of truth in *Metaphysics* Θ.10. Doing so will allow us to understand Aristotle's notion of "simplicity" in connection with truth, and thus to hang some flesh on the argument from simplicity to necessary truth that Aristotle gives in *Metaphysics* Δ.5.

## 4.2 Truth concerning incomposites: *Metaphysics* Θ.10

*Met.* Θ.10 presents Aristotle's theory of truth. The chapter is structured around a distinction between two varieties of truths. The first kind, which he treats for present purposes as the more straightforward case, is introduced as follows:

> **T48** on the side of things this is in virtue of their being combined or divided, so that the person who thinks what is divided to be divided or thinks what is combined to be combined thinks truly, and a person thinks falsely whose state is in opposition to the [state of the] things.[43]

Aristotle gives an account of what makes a truth or falsity of the first kind true or

42. Ross (1958c, 1:365), Crivelli (2004, 63–64), Oehler (1962, 29:170–2) and Aquinas *in Met.* §1233 all take the reference to another discussion at 1027b.28–29 to be to *Metaphysics* Θ.10 (Aquinas takes the promise to be fulfilled also in *De Anima* and in "the logical works [*in logicalibus*]," since "the whole of logic seems to be devoted to the being and non-being spoken of in this way [*tota enim logica videtur esse de ente et non ente sic dicto*]"). There is a much-discussed tension between Aristotle's promise to discuss this sense of being later and his remark at 1027b.34–5 that being in the sense of truth is to be left aside; see Jaeger (1912, 21–28, 49–53), and the responses in Crivelli (2004, 63n.66), Oehler (1962, 29:170–2), and Leszl (1975, 216).

43. τοῦτο δ' ἐπὶ τῶν πραγμάτων ἐστὶ τῷ συγκεῖσθαι ἢ διῃρῆσθαι, ὥστε ἀληθεύει μὲν ὁ τὸ διῃρημένον οἰόμενος διῃρῆσθαι καὶ τὸ συγκείμενον συγκεῖσθαι, ἔψευσται δὲ ὁ ἐναντίως ἔχων ἢ τὰ πράγματα, *Met.* Θ.10, 1051b.1–5.

false.[44] In this case, the truth of a thought or utterance consists in that thought or utterance containing parts which are combined by affirmation or separated by denial in a way that mirrors the combination or separation of the worldly entities which the predicative components of the thought or utterance signify. A thought or utterance of this kind has the form "S is P," and it is true at those times when the subject signified by S really does have the property signified by P. Falsity for these types of thoughts or utterances consists in one's utterance or thought being "in opposition to the [state of the] things" – that is, either in affirming a predicate of something which lacks the property signified by that predicate, or denying a predicate of something that has the property signified by it.

Aristotle goes on to give two examples, intended to illustrate different sub-cases. The first, "the log [being] white,"[45] is intended to illustrate a state of affairs that may hold at some times but not at others. When the log, previously brown, is painted white or grows white mold, whiteness "combines" with the log. A person's belief or utterance that the log is white correspondingly becomes true as a result of the change in this state of affairs. Aristotle's other example is "the diagonal [of a square] being incommensurate with the side."[46] This state of affairs does not change in truth-value. This is because, as

44. Compare *Sophist* 287b. Crivelli (2004, 65) takes Aristotle to be ascribing truth to non-linguistic and non-mental objects (*pragmata*) which are combined or divided themselves in this passage. But on this reading Aristotle is contradicting his claim in *Met.* E.4 that "truth and falsity are not in things" (1027b.25). Here I offer an interpretation which takes Aristotle to be consistently committed to the claim in E.4 that non-linguistic and non-mental objects are not bearers of truth. In this passage, he is describing the state of affairs which *makes* a composite thought or utterance true, he does not attribute truth or falsity to that state of affairs (note the dative at 1051b.2). Crivelli's own resolution of the two texts relies on a distinction between two types of truth that is difficult to motivate; see Crivelli (2004, 64–66). For a carefully spelled out alternative to Crivelli's position broadly in agreement with the reading offered here, which also shows that this type of reading is compatible with the α text of this chapter, see Charles and Peramatzis (2016).

45. *Met.* Θ.10, 1051b.20.

46. *Met.* Θ.10, 1051b.20–1.

Aristotle puts it, the diagonal of a square is "always" combined with incommensurability.[47] Regardless of how we manipulate the proportions of a square, the diagonal of a square will never go from being incommensurate to being commensurate with the sides, nor will we ever discover a square whose diagonal is commensurate with its side, since in any square the diagonal will be longer than the side by a factor of $\sqrt{2}$. Aristotle thus presents the incommensurability of a triangle's side as a necessary truth[48] that is made such by combination: Incommensurability is *permanently* and *in all cases* combined with the side of a square, joined, as it were, by metaphysical superglue.

Aristotle thus identifies the truthmakers of these truths, whether necessary or contingent, as complexes consisting of subjects and predicates in either a combined or divided state.[49] Both an accidental predication like "the log is white" and a necessary predication like "the diagonal is incommensurate with the side" are presented as being made true by the combination of a subject and a property, the difference being that, in the latter case, the combination is constant and universal, whereas in the former, it is temporary or sporadic.

Aristotle maintains, however, that not all true statements are made true by the constant combination of an attribute with its subject. Truthmakers for some statements and thoughts have a different structure. These are instead made true by the presence of some unitary structure that does not contain parts to be combined or divided. This means, as Aristotle recognizes, that the account he has given so far is limited in scope. He turns to consider a different type of case, truth "concerning incomposites:"

47. *Met.* Θ.10, 1051b.9.

48. Aristotle does take the truth which results from permanent combination to be necessary truth: See *Met.* Θ.10, 1051b.15–16.

49. Cf. Makin (2006, 248), Charles and Peramatzis (2016, 124–40).

**T49** Then concerning the incomposites, what is it to be or not to be and what is truth and falsity? For it is not composite in this case, in such a way as to be when combined and not be when divided, as it is in the case of the wood being white or the diagonal being incommensurable; nor will truth and falsity still obtain in the same way as in these cases.[50]

It is important to note that Aristotle takes what is "not composite" to be the thing that plays the role of what is divided and combined in the former case. This was the state of affairs like the log being white or the diagonal being incommensurate, which provided for the truth and falsity of thoughts and utterances with these as their contents. Thus we should take Aristotle here to mean that, in the case of incomposites, what makes a thought or utterance true or false is not a state of affairs that may exist combined or divided.

In fact, Aristotle goes on to claim, there is no such thing as falsity in this case. But, he emphasizes:

**T50** there *is* something true: Touching and saying is true (for affirmation and saying are not the same), while to be ignorant is to fail to touch[51]

This passage should be read in light of Aristotle's remarks in *Metaphysics* E.4 that truth and falsity concerning simples is "not in discursive thought."[52] Truths concerning incomposites are those which are not made true by the combination of an object with an attribute. Hence, ascertaining such a truth cannot be a matter of combining a corresponding subject and predicate in thought.[53] Aristotle infers that a bearer of this type of truth

50. περὶ δὲ δὴ τὰ ἀσύνθετα τί τὸ εἶναι ἢ μὴ εἶναι καὶ τὸ ἀληθὲς καὶ τὸ ψεῦδος; οὐ γάρ ἐστι σύνθετον, ὥστε εἶναι μὲν ὅταν συγκέηται, μὴ εἶναι δὲ ἐὰν διῃρημένον ᾖ, ὥσπερ τὸ λευκὸν ξύλον ἢ τὸ ἀσύμμετρον τὴν διάμετρον· οὐδὲ τὸ ἀληθὲς καὶ τὸ ψεῦδος ὁμοίως ἔτι ὑπάρξει καὶ ἐπ' ἐκείνων, *Met.* Θ.10, 1051b.17–22. Reading τὸ λευκὸν ξύλον with the mss.

51. ἀλλ' ἔστι τὸ μὲν ἀληθὲς, τὸ μὲν θιγεῖν καὶ φάναι ἀληθές (οὐ γὰρ ταὐτὸ κατάφασις καὶ φάσις), τὸ δ' ἀγνοεῖν μὴ θιγγάνειν, *Met.* Θ.10, 1051b.24–25. Accepting Christ's deletion of ἢ ψεῦδος, but otherwise reading with Jaeger.

52. *Met.* E.4, 1027b.28 (T47).

53. Cf. *De An.* III.6, 430a.26–27.

cannot be the type of thought that consists in a mental act of combination or division. Rather, the type of thought that grasps truth concerning incomposites has the structure of a "touching."

In addition to making the point that there is no falsity in this case, Aristotle is thus here characterizing the *bearers* of truth concerning incomposites. The thoughts that are "true" in this case are acts of non-discursive thought (*nous*) rather than discursive thought (*dianoia*), and he adds that the utterances which are in this case derivatively said to be true are "sayings" rather than "affirmations."[54] This is the type of thinking Aristotle associates with the grasp of first principles and essences. Whereas we have knowledge (*epistēmē*) of the conclusions of demonstrations, Aristotle prefers to say that we have not knowledge but rather non-discursive thought (*nous*) of the first principles of demonstrations.[55] He mentions non-discursive thinking (*nous*) twice in the ensuing discussion. He mentions it first while explaining why such thoughts do not permit of error:

**T51** concerning these there is no error but there is [merely] non-discursive thinking or not[56]

Thoughts of incomposites do not permit of error.[57] We are only ever "accidentally"[58] in error regarding an incomposite. This is because there is no possibility of having a thought about that type of object that is not also a true thought about it. Instead:

54. Cf. Oehler (1962, 29:186), Seidl (1971, 181), Asclepii *in Met.* 374.8, Alexandri *in Met.* 458.6–7.

55. The locus classicus for this claim is *Post. An.* II.19, 100b.12. But see *Post. An.* I.33, 89b.36.

56. περὶ ταῦτα οὐκ ἔστιν ἀπατηθῆναι ἀλλ' ἢ νοεῖν ἢ μή, *Met.* Θ.10, 1051b.31–32. Reading ἐνέργειαι with Ross for Jaeger's ἐνεργείᾳ.

57. Cf. *Met.* Θ.10, 1051b.25.

58. *Met.* Θ.10, 1051b.26.

**T52** being correct and non-discursive thinking are the same [in the case of incomposites]: There is no false [thinking], nor error, rather ignorance.[59]

Aristotle's idea here is that to have a non-discursive thought of an incomposite is *ipso facto* to have a true non-discursive thought of it. That is why there is no falsity of thoughts concerning incomposites. The idea, presumably, is that in order to have a *false* thought or make a *false* utterance about something, that thought or utterance must be both (i) about that thing, and (ii) false. But in the case of truth concerning incomposites, condition (i) alone guarantees that the thought or utterance is true. Hence there is never a thought or utterance which is both about an incomposite and false, in other words, never a false thought or utterance about an incomposite.

So far, I have focused on the *bearers* of incomposite truth, and Aristotle's reasons for disallowing falsity and error in this case. What then *are* incomposites, and in what sense is a thought or utterance about one of them "true"?

### *4.2.1 The term reading and the existential reading*

Some commentators take Aristotle here to be distinguishing an alternative *sense* of truth with his discussion of truth concerning incomposites. That is, they take Aristotle to be identifying a different meaning of "true" when applied to an incomposite. On one version of this view, the incomposite items are simply the items which combine to form composite items: Things like the white and the log considered in isolation, as opposed to the state of

59. τὸ δὲ ἀληθὲς τὸ νοεῖν ταῦτα· τὸ δὲ ψεῦδος οὐκ ἔστιν, οὐδὲ ἀπάτη, ἀλλὰ ἄγνοια, *Met.* Θ.10, 1052a.36–37.

affairs *that* the log is white.[60] On this reading, Aristotle's distinction between composites and incomposites turns out to be a distinction between (the real correlates of) predicates and terms. The apparently mysterious notion of grasping incomposite truths turns out to be simply a distinction between thought *of* and thought *that*: Thinking *of* a log or *of* white, as opposed to thinking *that* a log is white or *that* white is a color, etc.[61]

This interpretation is able to explain why incomposite thoughts are never false or in error, since a term like "log" cannot be false; and a thought which is not of a log is not an incorrect thought of a log, it is simply a thought of something else. It also makes sense of Aristotle's claim that the type of utterance which bears this sort of truth is a "saying" or "stating"[62] rather than an "affirmation,"[63] since the statement of a term is not a type of assertion, as Aristotle takes an affirmation to be.[64] But on this reading, it becomes hard to understand why Aristotle would want to attribute truth to incomposites. For, as Aristotle himself acknowledges, terms like "white" on their own are *neither true nor false*; it is only

60. This claim is defended explicitly by Berti (1978, 147). Makin (2006) also lists it as a possible reading of the passage; see below. See also Shields (2016, 332) (commenting on the parallel passage in *De Anima* III.6): "it is fairly clear that Aristotle's distinction between synthesized and unsynthesized objects of reason approximates, if inchoately, a familiar distinction between concepts and propositions." In general, this move is encouraged by taking the incomposites (ἀσύνθετα) of *Metaphysics* Θ.10 to be the same as the indivisibles (ἀδιαίρητα) of *De Anima* III.6, but circumspection is called for here: *Metaphysics* Θ.10 is about a certain types of reality and the truths that pertain to them; Aristotle discusses the types of thought that pertain to the incomposites only in the service of clarifying their nature. *De Anima* III.6, by contrast, has as its focus a certain type of *thought*. It is for that reason more plausible that the "indivisibles" of *De Anima* III.6 are, as Berti (1978) suggests, things *considered as indivisible* rather than things that are actually indivisible, and it is possible that Aristotle there treats that distinction as co-extensive with the distinction between terms and predications, but I see no good reason for taking the incomposites of Θ.10 to be things merely *considered as* incomposite. Aristotle is here making a distinction among *things* (πράγματα, 1051b.2, 5), not thoughts about them.

61. Cf. Shields (2016, 333).

62. φάσις, *Met.* Θ.10, 1051b.25.

63. κατάφασις, *Met.* Θ.10, 1051b.24.

64. ἀπόφανσις, *Post. An.* I.2, 72a.11–14.

in combination with something else that they may be taken to be true or false.[65] Yet Aristotle's view is that thoughts concerning incomposites are *true*,[66] even if they cannot be false.[67] It is not clear in what sense a term, rather than a predication, can be "true."

In response to this problem, one commentator has suggested that Aristotle is using "true" and "false" in an extended sense, to mean something more like "being right" and "being wrong" in *Metaphysics* Θ.10.[68] Even if a thought of a term cannot be true, there are certain situations in which a thought of one term, but not another, can be the *correct thought to have*, such as in a search for a definition of some other term, and in this sense a thought of a term or a single concept can be "true," namely when that term or concept actually is the definiens for some contextually specified definiendum. But if this response is made, the reading faces another problem: It then seems that we have just as much motivation for calling hitting on the right term "truth" as we have for saying that failing to hit on it is "falsity." For if we say that truth is making contact with the right term or the relevant definition, then why isn't falsity making contact with the wrong term or

65. *Cat.* 4, 2a.7–10, *De Int.* I, 16a.9–18. Cf. Sorabji (1980, 218), Colaner (2015, 81).

66. *Met.* Θ.10, 1051b.24.

67. *Met.* Θ.10, 1052a.2. Shields (2016, 332) (commenting on *De Anima* III.6) and Makin (2006, 249) (on *Metaphysics* Θ.10) take their respective interpretations to be supported by Aristotle's language in *De Interpretatione* and the *Categories*, where Aristotle clearly means terms by "things spoken of without combination," and things spoken of "with combination" are predications (*Cat.* 4, 1b.25, 2a.4–10). But the word for "combination" here is different: "Combination" in *Categories* 4 is συμπλοκή, whereas in *Met.* Θ.10 (1051b.10, 19) and *De An.* III.6 (430b.1) the terms Aristotle uses are built from συντίθημι. In *De Int.* I.1, Aristotle does *compare* terms to incomposite thoughts, saying that "names and verbs themselves are like thoughts without synthesis and division" (16a.13–14). But this is only a comparison, not an identification. Terms resemble incomposite thoughts in that both are building blocks of more complex semantic structures, and also in that they do not admit of truth and falsity in the way that the complexes they are built out of do. But they are not identical to incomposite thoughts, nor are incomposite thoughts thoughts *of* terms.

68. See Makin (2006, 252).

definition?[69]

In other words, the term reading faces a dilemma. Either Aristotle is talking about contact with a term in a context like looking for a definition where something makes it the case that certain terms are correct and not others; or else Aristotle is talking about contact with a term in a context where nothing makes one thought of a term more correct than another. In both cases, truth and falsity are on all fours: In the former case, there is available a notion of being "true" (being the true definition, say), but there is also available a notion of being "false" (being the wrong definition). In the latter case, there is not available any notion of being true or false. This reading must therefore impute to Aristotle a slide from thinking of a case in which there is a contextual standard for what counts as the true term when he claims that thoughts about the incomposites can be true, to one in which there is no such standard when he says that they are never false. The reading cannot make sense of why, across a consistently conceived scenario, that should be an asymmetry between truth and falsity concerning the simples.

An alternative to the term reading is to take Aristotle's distinction between truth concerning incomposites from truth concerning composites to be a distinction not between *senses* of "true" applied to categorically different things, but rather a distinction between the *grounds* for the truth (in the ordinary sense) of different types of statements and thoughts. That is, Aristotle is distinguishing what *makes* certain truths true from what makes others true. A reading of this kind is developed by Paolo Crivelli, who affirms that the incomposites Aristotle speaks about in *Metaphysics* Θ.10 are propositional in structure, and thus subject to truth in the usual sense, but denies that they are *predicative* proposi-

69. On a linguistic level, the point is that if we take ἀληθεύειν in the sense of "to be right" (rather than "to be true") then ψεύδεσθαι is naturally understood as meaning "to be wrong" (rather than "to be false"). But if we can be right about what the appropriate term or concept is, we can surely be wrong about it, too. This implies that we can both ἀληθεύειν and ψεύδεσθαι in the case of incomposites, contrary to Aristotle's claim that we can only ἀληθεύειν.

tions. Crivelli instead takes thoughts and statements about simple entities to be existential assertions[70] concerning incorporeal substances, in particular, statements of the existence of God and the intellects that move the heavens.[71] His reading has the advantage of making sense of Aristotle's claim that statements of simple truths are not "affirmations,"[72] since Aristotle often reserves the term "affirmation" for a predicate with a subject, copula and predicate, whereas his standard locution for an existential predication uses a subject with an uncomplemented copula.[73] It also makes some sense of the contact metaphor, in so far as making a true statement of existence is a matter of making contact with a unitary thing (making contact with the thing that exists).

This reading also suffers from a number of problems, however. First, it too makes it difficult to see why we cannot be in error about incomposites. Crivelli's restriction of the subjects to God and the other intellects that move the heavens is suggestive in this regard, but he does not explain why we cannot be in error regarding the existence of these types of objects in particular. In fact, there is some evidence that Aristotle does take it to be possible to be mistaken about whether there is a god: "Whether there is a god" is one of his examples of a question as to "whether it exists" introduced at the beginning of *Posterior Analytics* II.[74] Second, Aristotle's use of the verb 'to be' without a complement in connection with this sort of truth does not seem intended to describe the content of incomposite thoughts, as Crivelli seems to assume. Aristotle says:

70. Crivelli (2004, 99–116).

71. Crivelli (2004, 116–21).

72. κατάφασις, *Met.* Θ.10, 1051b.24.

73. See *De Int.* 10 with Nuchelmans (1992).

74. *Post. An.* II.1, 89b.33.

**T53** To be as true and to not be as false is one thing [in the case where], if the object is combined, [the thought or statement] is true, and if it [the object] is not this way, [the thought or statement] is not; it is another thing [in the case where], if the being exists, it is so, and if it is not so, it does not exist[75]

What Aristotle is contrasting here is not the *content* of composite and incomposite thoughts, but rather their respective truth conditions. We have seen that a composite truth is made true by the combination or division of things corresponding to its semantic parts. An incomposite thought is made true by something holding of the type of object which, "if it exists, then it is so, and if it is not so, then it does not exist" (T53). Aristotle is saying here that the existence of an incomposite is *sufficient* to render true the truths that concern it, since its existence implies that it has any property it actually has. I will return to this idea below. Here, the point I wish to extract is that Aristotle does not say that incomposite thoughts or assertions are statements *of* the existence of this type of object or anything else; they are statements somehow *made true by* the existence of this special type of object.

Crivelli's reading also sits ill with a number of passages which suggest that Aristotle includes definitions among this type of truth, the statement of a thing's essence. Aristotle defends his claim that one can only be ignorant or have a true thought about incomposites by saying "for there is no error concerning the essence, except accidentally."[76] While it is *possible* that Aristotle is talking about thinking of the existence of some term that is something else's essence, without thinking *that* it is this thing's essence, it is more natural to take Aristotle here to be talking about a thought that predicates something's essence of that thing.

75. τὸ δὲ εἶναι ὡς τὸ ἀληθές, καὶ τὸ μὴ εἶναι τὸ ὡς τὸ ψεῦδος, ἓν μέν ἐστιν, εἰ σύγκειται, ἀληθές, τὸ δ' εἰ μὴ σύγκειται, ψεῦδος· τὸ δὲ ἕν, εἴπερ ὄν, οὕτως ἐστίν, εἰ δὲ μὴ οὕτως, οὐκ ἔστιν, *Met.* Θ.10, 1051b.33–1052a.1.

76. ἀπατηθῆναι γὰρ περὶ τὸ τί ἐστιν οὐκ ἔστιν ἀλλ' ἢ κατὰ συμβεβηκός, *Met.* Θ.10, 1051b.25–26. Cf. *Met.* Θ.10, 1051b.30–31. See note 82 on p. 158.

The fact that Aristotle defends his claim that incomposite truth is not subject to error this way strongly suggests that at least some incomposite truths are statements of a thing's essence, and thus that not all incomposite truths are existence statements, as Crivelli maintains. An alternative that accords with this observation is proposed by Richard Sorabji. In light of the problems with the concept reading discussed above, Sorabji suggests that incomposite thoughts are "definitions of incomposite subjects which state what their essence is."[77] Incomposite truths are thus, for Sorabji, propositional. But they are also for him not exactly predicative. Sorabji takes such statements to be "*identity* statement[s]."[78] This allows him to give a different reading of the contact metaphor:

> The idea will be that if you try to take an incomposite subject and assign it an essence which does not belong, you will not have made contact with the subject at all.[79]

Sorabji offers a satisfying way to understand the contact metaphor: If I misdefine a point, as, say, an extended magnitude, there is a sense in which I am not talking about a point at all. For I am explicitly defining the thing that I am talking about as something having extension, and this means that I am not talking about a point, even if I use the word "point." Instead, I am talking about a line – despite my use of the word "point."[80]

77. Sorabji (1980, 218); cf. Berti (1978, 149).

78. Sorabji (1980, 218).

79. Sorabji (1980, 218).

80. Cf. also *Post. An.* I.33 89a.29–32, where Aristotle makes the point that someone who thinks that the diagonal of a square is commensurate with its side in a certain sense does not have a belief about the diagonal.

My definition fails to make contact with the point at all.[81] By the same token, Sorabji's reading explains why there is no error in incomposite truths: Any mistake in my definition of a point is enough to undermine my reference to points in that statement. And so the only options are that I *correctly* define a point, or that I am not making a statement about points at all. There is no room for giving an incorrect definition of a point, there can only be an "accidental" error about the definition of a point.[82] Any definition that is genuinely a definition *of* a point is a correct definition of it.[83]

This is plausible for the example of defining a point. But is not as obvious – and Aristotle in fact does not seem to hold it to be true – for the definitions of other things. On Aristotle's view of inquiry, it is impossible to grasp the essence of something without first establishing the existence of things of that kind.[84] Our grasp that things of the

81. An interesting comparison may be drawn here with modern essentialism. For Kripke and other modern essentialists, a proper name or a natural kind term has its reference fixed by an initial act of ostension (Kripke 1980, 96). Any future speaker whose utterance is caused in the appropriate way by a chain of acts of reference leading back to this initial ostension thereby refers to the same kind (Kripke 1980, 96–97). On this view, one can be mistaken even about very basic features of kinds while still succeeding in referring to them, so long as one's utterance exists as part of this causal chain. Will a modern essentialist then disagree with Aristotle that the speaker who misdefines a point is not referring to a point? Perhaps – but a "point" is not exactly a natural kind term, and it is not clear how the Kripkean account ought to be extended to accommodate it. On the differences between Aristotle's essentialism and modern, post-Kripkean essentialism, see Charles (2000, esp. 1–22 and 348–72). For a reading that makes Aristotle's essentialism closer to Kripke's, see Bolton (1976). See also Witt (1989, 180–97).

82. In speaking of an "accidental" error, Aristotle perhaps has in mind the way that someone might incorrectly use the same word that others correctly use to refer to the misidentified object in question. The fact that one has the wrong conception of it means that the successful usage is nevertheless "accidental." Cf. *Post. An.* I.33, 89a.33–36 with Morison (n.d.).

83. Sorabji's reading has more trouble explaining why Aristotle does not take statements that are true in this sense to be "affirmations," but he points to a passage (*De An.* III.6, 430b.27–29) in which Aristotle may be read as denying that statements of something's essence are "one thing of another" (τὶ κατά τινος). That gives grounds for denying that such statements are affirmations, if all affirmations are required to be "one thing of another."

84. *Post. An.* II.8, 93a.20, 26–27.

relevant kind exist may take either of two forms. In some cases, we know that the relevant things exist without yet having any handle on what they are – Aristotle calls this having an "incidental" grasp of their existence.[85] But in what Aristotle takes to be the scientifically favourable case, our grasp of the existence of something includes a grasp of "something of the thing itself:"[86]

> **T54** Sometimes we possess something of the thing itself, for example of thunder, that it is a noise of the clouds, of an eclipse, that it is a certain privation of light, of the human, that it is a certain animal, of the soul, that it moves itself[87]

Such preliminary definitions are partial, but they make inquiry "easier"[88] because they provide us with a starting point in our search for the full definition: We merely need to find out what *sort* of noise in a cloud thunder is, what *kind* of privation of light causes an eclipse, what *type* of animal the human is. Hence, although we do not at this stage yet have a complete grasp of the definition, and so do not represent it completely, we still make "contact" with the thing in question in the sense that we manage to successfully refer to it in speech or in thought. So it appears that we can have definitional thoughts about things which do not express their definitions fully, at least for certain kinds of definienda.[89] And if this is possible, it is hard to see why we couldn't even have *false* thoughts about definitions: For why couldn't we, at some stage of our inquiry, falsely hypothesize that an eclipse was a privation of light due to the moon containing its own light-source that sometimes dims, or thunder the noise of fire being suddenly ignited in a cloud? Surely a

85. *Post. An.* II.8, 93a.21.

86. τι αὐτοῦ τοῦ πράγματος, *Post. An.* II.8, 93a.22.

87. ὁτὲ δ' ἔχοντές τι αὐτοῦ τοῦ πράγματος, οἷον βροντήν, ὅτι ψόφος τις νεφῶν, καὶ ἔκλειψιν, ὅτι στέρησίς τις φωτός, καὶ ἄνθρωπον, ὅτι ζῷόν τι, καὶ ψυχήν, ὅτι αὐτὸ αὑτὸ κινοῦν, *Post. An.* II.8, 93a.22–24.

88. ῥᾷον, *Post. An.* II.8, 93a.28.

89. Compare Code (15).

scientist who knows that an animal is a certain type of biped can be mistaken about *what* type it is. Given that we have "something of the essence," there could be little reason deny that such thoughts are thoughts *about* the relevant definienda, even if incorrect ones.

The truths about incomposites cannot, then, be definitions of just *any* objects. They must be truths about a special kind of object, namely the incomposite ones.[90] Sorabji in fact suggests that the subjects of incomposite truths may need to be of a special kind,[91] but he gives no characterization of them beyond calling them "incomposite subjects," and no account of how this type of subject renders definition an all-or-nothing affair in such a way as to rule out incorrect definitions of them. Yet in the absence of such an account, Sorabji's suggestion that incomposite truths are simply definitions loses much of its force, since Aristotle seems to accept definitions that are not "all or nothing" in the way Sorabji suggests. Given that Aristotle's incomposite truths must be about a special type of object, it is incumbent on a satisfactory reading to describe what this type of object is, and to explain how this gives thoughts and truths about incomposites the features Aristotle ascribes to them. This is the task to which I turn now.

## 4.3 Incomposites as "things with no other cause"

In *Metaphysics* Z.17, Aristotle contrasts the way that inquiries proceed "in the case of simples"[92] with the procedure of inquiry concerning things that are not simple. About inquiry concerning simples Aristotle makes only the jarring comment that "there is neither inquiry nor teaching, but a different kind of inquiry from these kinds [sc., inquiries concerning

90. Contra Berti (1978, 148–49).

91. Sorabji (1980, 218).

92. ἐπὶ τῶν ἁπλῶν, *Met.* Z.17, 1041b.9.

composites]."[93] While Aristotle does not describe the procedure of inquiry associated with simples here, we may garner something about what simple beings are and how we know about them by considering Aristotle's account of the contrasting case.

An inquiry into why a composite kind exists, Aristotle claims, always takes the form of a question "why one thing is predicated of something else."[94] Aristotle gives the example of thunder. To know why there is such a thing as thunder is to know why a certain type of noise is produced in a cloud.[95] The inquiry into the reason for the existence of a complex phenomenon like thunder may thus be re-cast as an inquiry into why a certain predication holds:[96] Why clouds produce the characteristic rumbling noise that they do.[97] Such an inquiry presupposes that clouds do, in fact, produce this type of noise and asks why they do.[98] This holds not only for the existence of properties of subjects like thunder, Aristotle clarifies. The same thing holds for the existence of a substance like "human." To ask why there are humans is to ask why there are animals of a certain, characteristic sort.[99] This is not, as in the case of thunder, to ask why some underlying subject has the property human,[100] but it is still to ask why one thing is predicated of another: Why the differentia of human is predicated of the genus animal.

The same type of inquiry may be conducted, Aristotle clarifies, regarding the existence

93. ἐπὶ τῶν ἁπλῶν οὐκ ἔστι ζήτησις οὐδὲ δίδαξις, ἀλλ' ἕτερος τρόπος τῆς ζητήσεως τῶν τοιούτων, *Met.* Z.17, 1041b.9–10. Compare Aristotle's mentions of a special type of inquiry associated with non-composite substances (μὴ συνθετὰς οὐσίας) at *Met.* Θ.10, 1051b.32.

94. διὰ τί ἄλλο ἄλλῳ τινὶ ὑπάρχει, 1040a.11.

95. *Met.* Z.17, 1041a.24–25.

96. *Met.* Z.17, 1041a.25–26.

97. *Met.* Z.17, 1041a.25.

98. *Met.* Z.17, 1041a.23–24.

99. *Met.* Z.17, 1041a.20–21. The tradition would supply "rational" here, but Aristotle does not use this as the differentia of "human" in many places where we might expect him to. He prefers the (clearly simplified) differentia "two-legged," sometimes adding "tame." Cf. *Post. An.* II.13, 96b.30–35.

100. *Met.* Z.17, 1041a.22.

of individual instances of these kinds: To ask why there is a particular human is to ask why this body is "in such a condition" – that is, in the condition of having a human form.[101] Likewise, we may infer, to ask why there is thunder on a particular occasion is to ask why the cloud is presently producing this noise.[102] Thus, in *Metaphysics* Z.17, Aristotle treats both "human" and "thunder" as composite kinds, and the fact that these are composite means that they are subject to a certain kind of inquiry into why they exist, both at the particular and general level. The inquiry involves analyzing a question of generic or individual existence into a question of why some predication holds.[103]

*Posterior Analytics* II.1–2 and II.7–10 expands on this type of inquiry. An inquiry into the nature of thunder presupposes a "nominal" definition of thunder:[104] Say, that "thunder" refers to some ostensively given type of noise in a cloud.[105] In general, the nominal definition for a property of an underlying subject like thunder will have the form "K is F in G," where the extension of F and G may be specified ostensively.[106] The fact of there being Ks is thereby be reduced to a predicative fact: That (at least some) Gs are F; likewise the existence of a particular K is reduced to some particular G having property F. The nominal definition is not intended to replicate to capture the essence of Ks, for a complex K. It is rather intended to allow someone to *inquire into* the essence of Ks by giving her the capacity to locate the relevant phenomena whose explanation would constitute a grasp of their essence. This is because Aristotle holds that,

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101. *Met.* Z.17, 1041a.6–9.

102. Cf. *Post. An.* I.8 with my discussion in section 3.4.2.

103. See Byrne (1997, 123–63) on Aristotle's conception of analysis in this connection.

104. ὀνοματώδης, *Post. An.* I.10.

105. *Post. An.* II.8, 93a.22–23.

106. Bolton (1976) argues that such definitions always include demonstrative or deictic content ("*this* type of noise...", where the reference "this" is settled by some act of ostension). Whether or not we take all preliminary definitions to be of this sort, Bolton is right to emphasize this as one important kind of definition.

**T55** to know what something is and to know the reason for its existence are the same[107]

To know why there is thunder, for example, is to know why there is that ostensively specified noise in a cloud. Thus, Aristotle outlines the following procedure for discovering the essence of a kind like thunder. First, thunder is reduced to a nominal definition, like such-and-such a noise in the clouds. Subsequently, or simultaneously, the fact that there is such-and-such a noise in the clouds is established.[108] An explanation for there being such-and-such a noise in the clouds is then sought. When it is discovered (say, the noise of fire being extinguished), the inquirer is able to *prove* the nominal definition by way of first-figure syllogism that displays this cause as its middle term,[109] such as:

1. A certain noise holds of fire being extinguished,
2. Fire being extinguished holds of clouds,
3. Therefore, a certain noise holds of clouds.[110]

The definition of thunder may then be read off this syllogism: Thunder is (essentially) the noise of fire being extinguished in a cloud. The syllogism that proves the nominal definition is thus the real definition "arranged differently;"[111] it presents the same information

107. ταὐτὸν τὸ εἰδέναι τί ἐστι καὶ τὸ εἰδέναι τὸ αἴτιον τοῦ εἰ ἔστι, *Post. An.* II.8, 93a.4–8.

108. Whether this stage is always simultaneous with the first is subject to debate in the literature: *Pro* see Bolton (1976), Bolton (2018); *contra* see Charles (2000) and Bronstein (2016).

109. *Post. An.* II.8, 93a.7–9.

110. *Post. An.* II.10, 93a.5. In this syllogism the definiendum (thunder) does not appear; rather, the syllogism as a whole sets out the *definiens*. Sometimes, as in *Post. An.* II.8, 93b.9–10, Aristotle presents the relevant syllogism differently, taking the major term to be the definiendum, and consolidating the major and the middle in the syllogism above, viz.:

1. Thunder holds of a certain noise of fire being extinguished,
2. A certain noise of fire being extinguished holds of a cloud,
3. Therefore, thunder holds of a cloud.

On this issue see Ackrill (1981).

111. πτώσει διαφέρων, *Post. An.* II.10, 94a.12–13.

as a real definition in the form of a deduction rather than a definition.

The nominal definition of a kind like thunder is thus what allows the inquirer to investigate thunder *before* she has a grasp of its essence. It constitutes a grasp of the meaning of the term,[112] and tells her what thunder is to an extent that allows her to locate instances of thunder, without yet telling her what thunder is in the sense of telling her what explains its existence. This type of definition, one that provides a grasp of the term's meaning without yet settling the question of its essence, is what allows there to be an inquiry that takes place in multiple phases in the manner described above, first establishing the existence of thunder and then going on to investigate its essence.[113]

Complex phenomena like thunder (Aristotle often also mentions the eclipse) are to be distinguished, however, from simple ones like the arithmetical unit.[114] The latter have no middle term and hence their existence cannot be demonstrated by finding an appropriate middle term in a demonstrative syllogism. Instead, their existence must be postulated or "made clear in some other way."[115] Nevertheless, even in this case Aristotle holds that it is the same to know "what the thing is and the explanation why the thing exists."[116] The

112. *Post. An.* I.10, 93b.30.

113. In the background is the threat of Meno's paradox, which denies that inquiry can ever get going, since knowing what something is would already constitute the knowledge of the thing's essence that is sought. Aristotle is responding to the paradox by distinguishing the type of definition that allows inquiry to get started from the one that inquiry aims to discover. I owe this point to Robert Bolton. On Aristotle's response to Meno's paradox more broadly, see Bronstein (2016, 11–22) and Fine (2014, 179–225).

114. *Post. An.* II.9, 93b.24–25. It is tempting to identify the class of these simple phenomena with this class of "simple subjects" described at 90a.12–13. But Aristotle makes clear that there he means the distinction between subjects and attributes (90a.12). Aristotle's inclusion of "human" as an entity subject to the type of inquiry associated with non-simple items in *Met.* Z.17 (1041a.20–21), and his claim that one might have partial definition of humans at *Post. An.* II.8, 93a.23–24, makes these subjects composites on the view I am elaborating here. For a different view, see Bronstein (2016, 131–38). Views closer to mine are Deslauriers (2007, 66–80) and Kal (1988, 38).

115. *Post. An.* II.9, 93b.23–24.

116. *Post. An.* II.8, 93a.5–6.

difference, in this case, is that the explanation for why a unit exists does not consist in the presence of some *other*, more basic cause. The unit is the indivisible in quantity,[117] and so the unit exists if some quantity is indivisible, just as thunder exists if there is a noise in some cloud. The difference is that the fact there is a noise in a cloud (either at a certain point in time, or in general) does not follow solely from the nature of the cloud or from the nature of that type of noise. Instead, it is the presence of a further cause, the extinguishing of fire, inhering in the cloud that makes it the case that the cloud is presently thundering. And it is a fact about *fire*, that it produces a thunderous report upon extinction in the conditions provided by cloud, that makes it the case that clouds thunder.[118]

The unit's existence, by contrast, is not provided for in this way. While the unit exists as the divisibility of quantity, it is a fact about quantity *itself* that makes it the case that some quantities are indivisible. For there to be quantities *just is* for there to be indivisible units.[119] Thus, the existence of the unit does not have a further cause or explanation in addition to the existence of quantity. Consequently, it is not possible to find a middle term that explains why the unit is what is indivisible in quantity, and it is consequently also not possible to prove this stipulation of the meaning of "unit" by a syllogism as in the case of thunder's nominal definition, since no appropriate middle term is available.

Aristotle summarizes these points in *Posterior Analytics* II.9:

117. *Post. An.* I.2, 72a.22–23.

118. Cf. Goldin (1996, 124–25). In fact Aristotle's own scientific definition of thunder is somewhat different: See *Meteor.* II.9, 369a.22–29.

119. Cf. *Met.* M.3, 1078a.21–25.

**T56** There are some things of which there is some other cause and there are some things of which there is not. And so it is clear that also some essences are immediate and first principles, which it is necessary both to stipulate the existence and the essence of, or to make clear in some other way (which is just what the arithmetician does: For both what the unit is and that it is are posited). Those possessing a middle, i.e., of those of which there is a different cause of their being, can be, as we say, made clear through demonstration without demonstrating the essence.[120]

Composite and incomposite entities differ, then, in the relationship that the initial specification of the item in question has to the real definition that constitutes a grasp of its essence. In cases like thunder, the nominal definition is subject to further explication. Even if an inquiry defines thunder as a certain (ostensively specified) noise in a cloud,[121] the fact that thunder is a noise in the clouds is not inexplicable: Thunder is a noise in the clouds *due to* the quenching of fire.[122] A second, fuller type of definition of thunder can be empirically discovered which states this cause ("thunder is the noise in a cloud due to the quenching of fire")[123] and may be exhibited in a demonstration whose conclusion is the more minimal definition ("thunder is quenching of fire in a cloud, quenching of fire in clouds is a certain noise in clouds, therefore, thunder is a certain noise in a cloud").[124] For other objects, however, no such further explication or demonstrative exposition of the essence is possible. For the fact that such objects have "no other cause" means that there is no explanatory middle term which may be used to supplement the definition or construct a demonstration of it. Consequently, the statement of what a term of this kind means already

120. Ἔστι δὲ τῶν μὲν ἕτερόν τι αἴτιον, τῶν δ' οὐκ ἔστιν. ὥστε δῆλον ὅτι καὶ τῶν τί ἐστι τὰ μὲν ἄμεσα καὶ ἀρχαί εἰσιν, ἃ καὶ εἶναι καὶ τί ἐστιν ὑποθέσθαι δεῖ ἢ ἄλλον τρόπον φανερὰ ποιῆσαι (ὅπερ ὁ ἀριθμητικὸς ποιεῖ· καὶ γὰρ τί ἐστι τὴν μονάδα ὑποτίθεται, καὶ ὅτι ἔστιν)· τῶν δ' ἐχόντων μέσον, καὶ ὧν ἔστι τι ἕτερον αἴτιον τῆς οὐσίας, ἔστι δι' ἀποδείξεως, ὥσπερ εἴπομεν, δηλῶσαι, μὴ τὸ τί ἐστιν ἀποδεικνύντας, *Post. An.* II.9, 93b.21–28.

121. *Post. An.* II.8, 93a.22–23 with II.10, 94a.7–9 and 13–14.

122. *Post. An.* II.10b, 94a.3–5.

123. *Post. An.* II.10, 94a.5.

124. *Post. An.* II.8, 93b.8–12.

tells us everything there is to know about what a thing of that kind is. It is definitions of these, simple kinds which give the essence of this type of object, those with no other cause, that are "indemonstrable" and may serve as principles of demonstrations.[125]

The language Aristotle uses to draw this distinction in T56 parallels that of *Metaphysics* Δ.5, which also employs the locution "some other cause."[126] The distinction being drawn is not the same, but it is closely related. In *Met.* Δ.5, Aristotle is distinguishing between necessities which do and do not have their ground in some other necessity; here, Aristotle is distinguishing between subjects whose essence is, and whose essence is not, further explicable. The connection is this: Necessities that have their ground in no other cause are precisely statements of the existence and essence of simple or incomposite objects, things whose essence has no other cause.[127] The (nominal) definition of thunder may not serve as a first principle because nothing in this definition rules out there being an instance of thunder that is not due to the quenching of fire. What makes this necessary is a more basic definitional fact, that the type of rumbling noise in question is the noise of fire being quenched in a particular way, and that this type of fire-quenching can only take place in a cloud.[128] Thus, while it is necessary that thunder is a certain type of noise in a cloud, this necessity is ultimately due to other, more basic essential facts. On the other hand, there are no more basic facts which explain the nominal definition of a unit. The fact that the essence is not further explicable in this way means that there can be no syllogism proving this definition and thus no demonstrative premises which transmit its necessity. This makes this type of definition fit to serve as a first principle itself, since it is made true by no other, more fundamental necessity.

125. *Post. An.* II.10, 94a.9–12.

126. ἕτερον αἴτιον, 1015b.10 (T43).

127. See also *Post. An.* II.13, 96b.21–25, which uses the language of simplicity explicitly to describe the subjects of definitions that may serve as principles.

128. See Code (16) and Bolton (1976, 135).

Metaphysics Θ.10, on this reading, thus distinguishes between *two* classes of necessities. There are those which are necessary on account of permanent combination, and those that are true on account of the simplicity of some kind. Within the scheme of *Metaphysics* Θ.10, the motivation for this complication is not easy to discern. Aristotle has, after all, already accounted not only for contingent truths but also for necessary truths with his framework of combination and division: Truths made true by the unfailing inherence of an attribute in a subject are necessary. Why add the extra complication that some truths are made true by truthmakers of an entirely different sort?

With the hindsight of our discussion of *Metaphysics* Δ.5, we are in a position to see why Aristotle has reason to introduce this distinction. In order to successfully answer the demarcation problem for demonstrative necessities without leading to a regress, Aristotle must explain how certain demonstrative truths differ in their intrinsic character, and how this renders them necessary. He is doing this here by introducing a structurally dissimilar class of truthmakers for those necessary truths that are foundational. These are what he in this chapter calls truths concerning incomposites.

This reading can help us to understand a number of difficult remarks Aristotle makes about incomposites in *Metaphysics* Θ.10. First, it can help us see why Aristotle takes error to be impossible regarding incomposites.[129] The fact that a grasp of the meaning of the term "thunder" does not settle the question of its essence allows for the possibility of false judgement regarding the nature of thunder. We can imagine two Aristotelian scientists who agree that thunder is a certain noise in a cloud. They also agree on a range of canonical instances or examples of thunder: When they go out and listen in a thunderstorm, they generally agree on whether a certain sound is the sound of thunder, although they might disagree on certain fringe cases, such as whether a particular distant muffled rumbling was thunder or not. But they disagree on what is ultimately responsible for the sound they

129. *Met.* Θ.10, 1052a.2.

are hearing: Scientist A believes that this sound is the sound of fire being extinguished in a cloud. Scientist B believes that this sound is the sound of lightning striking a cloud.

They cannot both be right: Even if it were to turn out that the extinguishing of fire in a cloud and being struck by lightning frequently or always coincide, there would remain a question as to which of these it was that actually produced the audible report. Nevertheless, the two scientists do not so fundamentally disagree that we would want to say they are talking past one another. They share enough common ground to have a *substantive* disagreement about what constitutes thunder, since they agree that it is a sound of a certain sort, and they at least agree on canonical instances of that sort. And so, in a certain sense, they both *make contact* with the phenomenon of thunder, even though at least one of them is not *correct* regarding the nature of thunder.

Contrast now another type of disagreement, a disagreement about the nature of a point. Scientist A believes that points are unextended in magnitude. Scientist B believes that points are extended in magnitude along one dimension. The character of this disagreement is different. Unlike the case above, it is difficult to see how such a disagreement could be *resolved*. It is difficult to see this because it is difficult to imagine what criterion or canonical instance the two parties could agree on and employ as a shared point of reference. If scientist A produces a point, and beside it a line, in order to illustrate that points are unextended, scientist B will simply deny that the first figure is a point. If scientist A attempts to show that the line *contains* points but is not itself a point, scientist B might agree, but when asked to give instances of points within the line will describe (what we would call) line segments rather than points. This reflects the fact that there is no possible space between a grasp of what "point" means and knowledge of what points really are: To so much as know the meaning of "points" is to grasp their essence in its entirety.[130]

There can be no error about the essence of an incomposite kind like points, because

130. Cf. *Post. An.* II.9, 93b.24–25, where Aristotle claims that *both* the essence and the existence of things with no other cause are assumed (ὑποτίθεται).

in this case an ability to so much as refer to the kind in question guarantees a grasp of its essence. We are never in error regarding incomposites not because we have a special infallible capacity to know them, nor because their definitions are always obvious, but rather because any error we make about such a kind's essence means we do not even succeed in referring to or thinking about (making "contact" or "saying")[131] the kind in question.[132]

This reading can also help us to make sense of Aristotle's characterization of the difference between truth in the case of composites and incomposites. Aristotle writes:

> **T57** To be as true and to not be as false is one thing [in the case where], if the object is combined, [the thought or statement] is true, and if it [the object] is not this way, [the thought or statement] is not; it is another thing [in the case where], if the being exists, it is so, and if it is not so, it does not exist[133]

Truths concerning incomposites cover both accidental truths (like the log is white) and demonstrable truths (like the diagonal is incommensurate). What these truths have in common, on Aristotle's view, is that they are made true by the inherence of some further attribute in the underlying kind or some difference in the underlying genus to which it belongs. Thus both the fact that the log is white and that the diagonal is incommensurate may be viewed, Aristotle thinks, as the outcomes of "combination," in so far as there is

131. *Met.* Θ.10, 1051b.24.

132. Aristotle nevertheless claims that there is a *certain* type of inquiry regarding these entities, as we have seen (*Met.* Z.17, 1041b.10–11). This type of inquiry is distinguished from the type of inquiry possible with composites because it does not consist in having an even preliminary grasp of the things in question beforehand. Aristotle is notoriously obscure about what this type of inquiry is: The traditional answer is induction or intuition (Kal 1988, 38; Kahn 1981; Bayer 1997; Irwin 1988, 18), but others have proposed division (Bronstein 2016, 189–222; Deslauriers 2007, 67) and inference to the best explanation (Charles 2000, 245–73).

133. τὸ δὲ εἶναι ὡς τὸ ἀληθές, καὶ τὸ μὴ εἶναι τὸ ὡς τὸ ψεῦδος, ἓν μέν ἐστιν, εἰ σύγκειται, ἀληθές, τὸ δ' εἰ μὴ σύγκειται, ψεῦδος· τὸ δὲ ἔν, εἴπερ ὄν, οὕτως ἐστίν, εἰ δὲ μὴ οὕτως, οὐκ ἔστιν, *Met.* Θ.10, 1051b.33–1052a.1. T57=T53.

some further feature which is "combined," in the one case sporadically and in the other permanently and universally, with the respective kinds (log and diagonal). This is reflected in the fact that the nominal definitions of complexes corresponding to these predications (a log when white, a diagonal that is commensurate) may be demonstrated. On the other hand, the existence of a unit corresponds to the fact that some quantities are indivisible. The truth of this fact does not consist in the combination of some feature with quantity. If quantity exists, then it has an indivisible unit; and, conversely, if units exist, then there is such a thing as quantity.[134]

We may now finally return to Aristotle's description of the "primary and governing" necessity in light of this. Aristotle had said:

> **T58** the primary and governing necessity is the simple: For this is not capable of being in multiple ways, and so it cannot be one way and another: For then it would already be in multiple ways.[135]

The primary and governing necessities are those that state the existence and describe the essences of objects that are "simple" in the sense of stating the essence and existence of simple objects. The necessity of truths about these types of objects may be explained, as we have seen, on the basis of their ontological structure rather than by recourse to more fundamental necessary truths. The existence of incomposite objects thus forms the most fundamental stratum of necessity, explaining the truths of all other necessities that occur in demonstrations and are grasped by someone with scientific knowledge.

134. Cf. *Met.* Θ.10, 1051b.35–36.

135. τὸ πρῶτον καὶ κυρίως ἀναγκαῖον τὸ ἁπλοῦν ἐστίν· τοῦτο γὰρ οὐκ ἐνδέχεται πλεοναχῶς ἔχειν, ὥστ' οὐδὲ ἄλλως καὶ ἄλλως· ἤδη γὰρ πλεοναχῶς ἂν ἔχοι, *Met.* Δ.5, 1015b.11–14.

## 4.4 Truths about incomposites and demonstrative principles

In order to substantiate this account, it must be shown how it coheres with what Aristotle has to say about demonstrative principles in the *Posterior Analytics*. To begin, let us consider more closely Aristotle's taxonomy of demonstrative principles, those truths on which a demonstrative science relies and which are not proven within that science. In *Posterior Analytics* I.2, Aristotle distinguishes a number of types of principle.[136] There are, first of all, *common axioms*. These are fundamental truths which are employed as basic premises in demonstrations across a number of sciences. Aristotle's favourite examples are the principle of non-contradiction and the law of the excluded middle, which he takes to apply in one form or other to all branches of knowledge,[137] and the axiom that "when equals are taken from equals, equals remain," which he notices has application both in arithmetic (where the "equals" are equal numbers) and in geometry (where the "equals" are geometrical figures of equal magnitude).[138] Aristotle also recognizes two types of principle that are specific to a single science. First, Aristotle takes a science to rely on assumptions of existence. These are assumptions about the existence, not of particular individuals, but rather of kinds of things. Particularly important among this class is an assumption of the existence of the *subject genus*, the *broadest* kind that the science studies.[139] Second, a science takes for granted certain, immediate truths that cannot be proven on the basis of any other predications within the science. To these Aristotle sometimes adds assumptions

136. *Post. An.* I.2, 72a.14–24.

137. *Post. An.* I.2, 72a.16–17, *Met.* Γ.3, 1005a.22–28.

138. *Post. An.* I.10, 76a.38–b.2.

139. *Post. An.* I.10, 76b.13.

regarding the meaning of terms.[140]

Aristotle thus recognizes four types of assumptions that underlie demonstrations. Yet in *Posterior Analytics* I.6, as we have seen, Aristotle claims that all (ultimate) demonstrative premises are *per se* necessities in one of the first two senses, implying that they are necessarily true in virtue of a definitional connection between terms.[141] Before we see how the existence of incomposite objects bears on this theory, something must be said regarding how this apparent multiplicity of principles relates to Aristotle's view that all ultimate demonstrative premises are *per se* truths in the first or second sense.

### *4.4.1 Proper principles and* per se *predications*

The key to seeing how these two doctrines cohere is to see, first, that not all of these unprovable principles figure as premises of demonstrations, and second, that Aristotle takes there to be a certain degree of interchangeability between posits of existence and statements of essence. I will focus first on the principles proper to a given science; I take up the status of common axioms below.

Aristotle takes both the terms and the truths of a science to be ordered as more or less "primitive," where one truth is less primitive than another if it may be proven on its basis, and one term is less primitive than another if its existence depends on the existence of the other (but not vice-versa).[142] As we have seen, Aristotle takes there to be an intimate

140. It is generally agreed in the literature that Aristotle recognizes these kinds of principles. There are serious interpretive issues regarding Aristotle's terminology, however. In particular, Aristotle's term "hypothesis" (ὑπόθεσις) is sometimes most easily understood as describing a (type of) immediate predication (*Post. An.* I.19, 81b.15), and sometimes a posit of existence (*Post. An.* I.2, 72a.21–24). Relatedly, the term "definition" (ὁρισμός or ὅρος) sometimes seems to refer to a definitional predication (*Post. An.* I.2, 72a.6), and sometimes only to the definiens (*Post. An.* I.10, 76b.35–36). I will not try to resolve these issues here. On this issue see especially Hintikka (1972), Landor (1981), Gómez-Lobo (1977), Gómez-Lobo (1980) and Malink (2017).

141. *Post. An.* I.6, 74b.5–12.

142. See Scholz (1975).

connection between predicative statements and the assertions that certain terms exist: If T is a non-primitive term, then the statement that Ts exist is metaphysically grounded in Ss being P for some S and P. For instance, for thunder to exist is for a certain noise to be produced in a cloud, and for the unit to exist is for some quantity to be indivisible.

As a consequence of this, Aristotle thinks that he can speak of the existence of non-primitive terms being *provable* in a science, even though his syllogistic framework does not allow there to be non-trivial demonstrations with conclusions of the form "Ts exist," since the logic underlying his demonstrative theory is syllogistic and as such relates only predicative propositions. Instead, Aristotle takes it to be *proven* that Ts exists when it is proven that S is P for some appropriate S and P such that T is nominally defined as P in S.

This means that a scientist's ability to prove the existence of complex kinds relies on her grasp of nominal definitions of these kinds. This is what allows her to *count* the demonstration of the fact that S is P as a proof of the existence of kind T. Importantly, such an assumption figures not as an added premise in the proof of the existence of Ts. Rather, this type of assumption, which Aristotle calls "what the term signifies,"[143] is what *licenses* one to take the proof that S is P as a proof of the existence of Ts.[144]

In parallel to this homology between the existence of kinds and the truth of predications, we have seen that Aristotle takes there to be a homology between the statements of essences of complex terms and the soundness of entire demonstrations. Aristotle illustrates what he means once again using the example of thunder: Thunder is the noise of fire being extinguished in a cloud, and the fact that a cloud thunders may be demonstrated from the facts that thunder is the noise of fire being extinguished, and this noise holds of a cloud.

That is, for a complex term T, the fact that S is P (which constitutes its existence)

143. *Post. An.* I.1, 71a.14–15, *Post. An.* I.10, 76b.15–16, *Post. An.* II.10, 94a.31–32.

144. Cf. Goldin (1996, 120).

is explicable, and a demonstration of this fact may be given within the science. Aristotle takes this demonstration to be a different way of presenting the same information that is contained in the definition of a complex term. Thus, the complete definition of P in this case is a demonstration with the terms arranged differently.[145] The latter homology holds, however, only for *complex* terms and *explicable* predications, as we have seen, whereas a homology between statements of the existence and predications may be taken to hold for *all* terms of the science.

To summarize, the claims here are that:

(a) If T is a non-primitive term, then there is an S, P and M, such that

  (i) the meaning of T presupposed by inquiry is "P in S," which is the nominal rather than the real definition of T,
  (ii) the statement that T exists is equivalent to the statement that P holds of S,
  (iii) there is a demonstration of the form "P holds of M, M holds of S, therefore, P holds of S," and
  (iv) the real definition of P is "P in S due to M"

(b) If T is a primitive term, then there is an S and P such that

  (i) the definition of T presupposed by an inquiry is "P in S," which is at the same time the real definition of T,
  (ii) the statement that T exists is equivalent to the statement that P holds of S, and
  (iii) there is *no* demonstration of the form "P holds of M, M holds of S, therefore, P holds of S,"

The homology between predications and existence statements, on the one hand, and demonstrations and definitions, on the other, means that the types of principles proper to

145. *Post. An.* II.10, 94a.2; cf. *Post. An.* II.10, 94a.12–13.

a science may be described in multiple ways. On the one hand, one may give a taxonomy of the primitives of a science focusing on the existence of primitive kinds:

1. Assertions of the existence of primitive kinds
2. Nominal definitions of primitive and complex kinds[146]

This will be an exhaustive list of the principles specific to a particular science under the assumption that every immediate predication "S is P" is the existence condition of some kind that falls within the subject genus of the science. Then the use of every immediate predication will be licensed either (i) because it is the existence condition of some primitive kind that is posited to exist, or (ii) because it is the existence condition of some complex kind whose existence is provable from immediate predications licensed by the proofs of the existence of more primitive ones.

On the other hand, under the assumption that the existence of both complex and primitive terms in the science are equivalent to some statement of the form "some S is P" or "all S are P," we may equivalently think of the principles as these predications rather than the nominal definitions of primitive terms. However, that will still not cover the existence of the broadest term in the science, the subject genus, since the science is limited to making predications using terms that are narrower than it, whereas a predication that corresponds to the existence of the subject genus will have a subject term wider than it.[147] Hence we cannot eliminate posits of existence entirely even under this assumption. We may, however, reduce the list to:

1. Immediate predications
2. Statement of the existence of the science's subject genus

146. This is plausibly how Aristotle presents the list of principles specific to a science at *Post. An.* I.10, 76a.31–36. Cf. Scholz (1975), Hintikka (1972, 64).

147. Cf. Hintikka (1972, 61–63).

3. Nominal definitions of complex terms[148]

### *4.4.2* Per se *truths and truths about incomposites*

This explains why Aristotle may take the principles proper to a science to include existence statements while nevertheless insisting that all demonstrative premises are *per se* predications in the first two senses. The idea will be that these express all and only indemonstrable syllogistic premises in the science. Statements of existence do not constitute further demonstrative premises. Instead, in combination with nominal definitions of the terms, they are what allows the scientist to view certain proofs as proofs of the existence of kinds.

How, then, is this framework related to the theory of incomposite truth that I have been discussing? My proposal is that the primitive kinds of any science are incomposite kinds. Given the framework above, that would explain, in a straightforward way, how the "simples" provide the ground of all demonstrative necessities. The simplicity of each incomposite kind explains why things of that kind exist necessarily. The indemonstrable premises proper to the science are *per se* predications that are either (i) licensed by existence of statements of the existence of these incomposite objects (along with their nominal definitions), or (ii) statements of the essence of composite kinds that are licensed by their nominal definitions in conjunction with a proof of this nominal definition ultimately on the basis of premises of type (i). The simple incomposite kinds would in this way explain both the existence statements and the immediate predications associated with the science.

It may help to spell this out with an example. The unit cannot fail to exist, given the existence of quantity. This is because the indivisibility of certain quantities is not due to the existence of some other causal factor. It is instead due to the nature of quantity itself. That some quantity is indivisible is thus an immediate *per se*$_2$ predication of quantity. The

148. Compare Aristotle's catalog at *Post. An.* I.10, 76b.11–16.

existence of the unit, together with the fact that the unit is what is indivisible in quantity, permits three *per se* predications to be used as premises:

1. The unit is what is indivisible in quantity, (*per* $se_1$),
2. Some quantity is indivisible (*per* $se_2$), and
3. Some quantity is the unit (*per* $se_2$)

The first assumption is simply the (nominal and real) definition of the unit, and thus a *per se* predication in the first sense. The second is the existence condition for the unit, which Aristotle sometimes expresses rather in the form of (3).[149] Under the assumption that the subject genus exists (that there are quantities), all three are necessitated by the existence of the unit.

On the other hand, a statement like

> Thunder is a certain noise in a cloud

is not a *per se* predication, because it may be proven. The expanded definition

> (All) thunder is the noise of fire being extinguished in a cloud

is, however, a *per se* predication in the first sense. While this predication is not provable, the existence of thunder *is* provable, and thus this needn't be assumed as an additional posit given the existence of the incomposites of the science. It cannot be syllogistically proven, but the scientist is licensed to use it as an indemonstrable premise if she has proven that a certain noise holds of clouds using "fire being extinguished" as a middle term.

*Per* $se_1$ and *per* $se_2$ predications may thus be thought of as grounded in the existence of the incomposites and the existence of the subject genus of the science. Since Aristotle

149. See note 110 on p. 163.

holds that all demonstrative premises are *per se*$_1$ and *per se*$_2$, it follows that all demonstrative premises are grounded in the existence of the incomposites, as Aristotle claims in *Metaphysics* $\Delta$.5, if we identify incomposites with simple entities as I have argued.

It does not follow, however, that all demonstrative necessities are grounded in this way. In particular, as we have seen, Aristotle holds that the *conclusions* of demonstrations are not *per se* in the first two senses. It follows that they are also not truths concerning incomposites in the sense of *Metaphysics* $\Theta$.10. This fits with his examples in *Metaphysics* $\Theta$.10. The fact that the diagonal is incommensurate with the side of a square is intended as an example of a demonstrable truth,[150] thus *per se* in the fourth sense. The reason why it is necessary that the diagonal of the square is incommensurate with the side is *not*, on Aristotle's account, that there is no further causal factor the presence of which explains this fact. The middle term of the demonstration of this fact will be just such a causal factor. Thus, the permanent truth of the incommensurability of the triangle with its side does not consist in the fact that no causal factor can be found which in principle could be removed. It consists, rather, in the fact that there is a causal factor, but that this causal factor will *always* hold, owing to more basic, *per se*$_1$ and *per se*$_2$ predications from which this can be proven, these in turn reflecting the existence of incomposite objects.

Truths concerning incomposites are thus only *immediate* demonstrative premises of a science. Aristotle conceives of the necessity of demonstrable predications as consisting in the permanent combination or entanglement of other more basic, necessary beings, rather than in the absence of any such beings to be combined. Conversely, even immediate definitional connections about complex objects of a science, such as squares in geometry, will not count as truths concerning incomposites. It follows that not all *per se*$_1$ and

150. Cf. *Met.* A.2, 983a.12–20 and *Pr. An.* I.23, 41a.23–7. Aristotle does not give much indication of what he takes the relevant demonstration to be (although the latter passage suggests a proof by reductio), but both passages make clear that Aristotle takes this fact to permit of demonstration.

*per se*$_2$ truths are truths concerning incomposites for Aristotle, but rather only those that are licensed by the postulation of the primitive items of the science. Even though immediate predications about complex subjects may not be proven syllogistically in the science, they are not needed as additional assumptions, because they are necessitated (non-syllogistically) by the existence of incomposite items.

### *4.4.3 Axioms*

We have now discussed how the simplicity of incomposite objects explains truth of two classes of principles: Statements of existence and definitional facts about kinds. The remaining class, axioms, is the most troublesome, since there are serious interpretive issues regarding how, or whether, these are grounded in the nature of the fundamental objects that a given science studies.[151] One interpretative possibility is, of course, that the axioms are *not* grounded in the simplicity of incomposite objects. That is suggested, in fact, by Aristotle's claim that the axioms, unlike the other types of principles, are things which "must be grasped if someone is to learn anything at all."[152] If the axioms are needed in order to learn about *anything*, then it may seem that their truth cannot lie in the nature of any particular kind of object, and *a fortiori* not in the nature of any particular simple kind of object. Perhaps they are instead what later philosophers would call "truths of reason."[153]

If this is so, then the simplicity of incomposites will not serve to provide a complete explanation for the necessity of first principles. Since Aristotle holds that no legitimate demonstration proceeds *solely* from common axioms,[154] the necessity of every demonstrable truth will still be at least partially reliant on the necessity of proper principles, and thus

151. The depth of this problem is brought out well in Bolton (1997, 117–9, 137–8).

152. *Post. An.* I.2, 72a.16–17.

153. But see Bolton (1997, 137–8) and McKirahan (1992 ch. 6, pp. 68–79).

154. *Post. An.* I.9, 76a.4–15.

at least partially reliant on the simplicity of incomposites. But those demonstrative truths whose demonstrations employ common axioms will partially derive their necessity in some other way.

This interpretation cannot be ruled out decisively. But in closing I wish to propose two alternatives that are at least comparably plausible, and which allow us to take Aristotle at his word when he marks out simplicity as the fundamental explanation for demonstrative necessity.[155] The first alternative accepts that the common principles do not rely on any kind's simplicity, but it denies that common axioms ever play the role of *premises* in demonstrations. Instead, they play some other role in demonstration. They might function as axiom schemata or rules of inference rather than axioms.[156] Or, they might be things on which the meaningfulness, rather than the truth, of demonstrations depend.[157] The second alternative is that axioms are premises of demonstrations, and they are grounded in the simplicity of objects in general, but not in the simplicity of any *particular* object or kind of object.

Now, if the common axioms are not premises of demonstrations, then the fact that their necessity has its seat elsewhere does not affect Aristotle's claim that all demonstrative truths are explained by simplicity, so long as "demonstrative truth" is understood narrowly as meaning a truth which occurs either as a premise or a conclusion of a demonstration. For Aristotle's argument in *Met.* $\Delta$.5 will still go through, namely:

1. Demonstrative principles are necessary because of their simplicity
2. Demonstrative conclusions are necessary because of the simplicity of demonstrative principles.
3. So, both demonstrative principles and demonstrative conclusions are ultimately nec-

155. In proposing some ways that the necessity of axioms might derive from the nature of certain objects, I take myself to be taking up the task described in Bolton (1997, 137).

156. See the appendix to this chapter (p. 190).

157. Cf. *Met.* $\Gamma$.3–4, esp. 1006a.18–26.

essary because of their simplicity.

There are two passages which most commentators interpret as descriptions of demonstrations containing common principles as axioms. In the appendix to this chapter, I show that at least one of these can be interpreted in such a way that it does not have Aristotle employ the common axiom in question, the Principle of Non-Contradiction, as a demonstrative premise. Also in favor of this interpretation is the fact that Aristotle does not tend to call the common axioms "premises" of demonstrations. He does call *principles* generally "immediate premises of demonstration,"[158] but he sometimes uses "principle" to refer to what he elsewhere calls more carefully "theses" (definitions and existence claims) or even definitions alone.[159] We should keep in mind that his word for principle is metaphorical (literally "beginning" or "source"), and leave open the possibility that the metaphor is meant to be interpreted differently for different types of principles. Perhaps the axioms are "sources" of demonstration in a way that differs from that of the other principles, viz. occurring as premises of demonstrative arguments.

This is one way that the claim that all demonstrative necessity derives from simplicity may be made to accommodate a separate source of the necessity for the common axioms. Above I said there was a second way that this result might be had. The second alternative accepts that common principles are not grounded in the simplicity of any *particular* domain of objects, but rejects the inference from this to the conclusion that they are not grounded in the simplicity of anything. Instead, this interpretation holds, the common principles are precisely those principles whose necessity derives from the simplicity of *multiple* domains of objects. They are abstract necessary features which hold of multiple, or even *any*, simple object.

The second interpretation fits especially well with one of Aristotle's main examples of

158. *Post. An.* I.2, 74b.7.

159. See especially *Post. An.* II.3, 90b.24; also *Post. An.* I.4, 75b.18 and *Post. An.* I.6, 74b.6.

common axioms, the principle that "when equals are taken from equals, equals remain," which Aristotle takes to have application in both geometry and arithmetic.[160] If this is, under the arithmetical interpretation, a consequence of the simplicity of the unit, then it is plausibly also, under the geometric interpretation, a consequence of the simplicity of the point.[161] The axiom is thus an abstract necessary feature which follows from the simplicity of different types of objects.

Although Aristotle says that all common principles apply only "analogically"[162] across different sciences, it is more difficult to see how this is supposed to be true for Aristotle's two other examples of common axioms, the Principle of Non-Contradiction (PNC) and the Law of the Excluded Middle (LEM). At least in the case of the PNC, however, there is something to be said for the idea that it relies on the simplicity of certain objects. For Aristotle sometimes qualifies the Principle of Non-Contradiction by adding that something cannot both belong and not belong *in the same respect*.[163] And the qualification is needed, since Aristotle also recognizes "accidental" beings which *can* have a property in one respect but not another. An example is "what happens to coincide with a house:" This being includes the contrary properties of being "beneficial and harmful,"[164] since a house may be beneficial to some (its occupants) while harmful to others (people who are displaced by its construction, for instance). Perhaps Aristotle holds that incomposites lack the sort of existential multiplicity that affords them different respects in which they might both have and lack a property. In that case, they would be subject to the stricter, unqualified law of non-contradiction that denies something contrary properties even in different respects. The qualified version of the law could then be understood as a derivative form of the law

160. *Post. An.* I.10, 76a.37–b.2.

161. Cf. *Post. An.* I.10, 76b.1–2.

162. *Post. An.* I.10, 76a.8–9; cf. Bolton (1997, 137–8).

163. κατὰ τὸ αὐτό, e.g. *Met.* Γ.3, 1005b.19–20.

164. *Met.* E.4, 1026b.7–8.

that applies to a wider range of entities, but which is true of them in virtue of the stricter law holding of the incomposites. In that way, the simplicity of objects would serve as a ground for the PNC.

These final proposals regarding the way that common axioms may figure in Aristotle's reduction of demonstrative necessity to simplicity are admittedly speculative. These wrinkles aside, the picture which emerges from our discussion is this. The necessities which pertain to demonstrative sciences come in two varieties. Some have their ground in the necessity of the principles. The others, the principles themselves, have the ground of their necessity in the simplicity of the objects about which they articulate definitions and existence conditions. The character of the entities about which principles articulate truths, and the type of features of them principles describe, provide the ultimate explanation for why each body of scientific truths is necessary. Simplicity thus serves as a demarcating criterion for scientific necessities. It explains, for Aristotle, why those necessities that feature in science, either as the explanatory principles or the explained generalizations, are necessary rather than contingent.

## 4.5 Incomposites in the natural sciences?

I have been working with "the point" and "the unit" as examples of incomposites. The reader may wonder whether this indicates that only mathematical and perhaps other immaterial kinds can be incomposites. There is some prima facie evidence that this is the case. In *Metaphysics* Θ.10, Aristotle draws a comparison of incomposites with "non-composite substances"[165] – that is, substances that consist of only form rather than a form-matter compound. He also compares incomposites with things "without change."[166] Yet if Aristotle does mean to limit the incomposites only to sciences of immaterial objects,

165. μὴ συνθετὰς οὐσίας, *Met.* Θ.10, 1051b.27.

166. ἀκίνητα, *Met.* Θ.10, 1052a.4.

his presentation of the simples as the things that underlie all demonstrative necessities in *Met.* Δ.5 will be misleading, assuming, as I have argued, that the simples there are the incomposites of Θ.10.[167] So it is worth looking more closely at this comparison to see if this is really what Aristotle means.

Aristotle makes the comparison with non-composite substances immediately after claiming that there is no "error" regarding incomposites save in an accidental sense.[168] Non-composite substances cannot perish, Aristotle argues, because for such a thing to perish it would have had to have come into being, and for it to come into being, it would have had to have come into being "from something."[169] Aristotle is here adverting to a theory of generation according to which a generation consists in matter taking on a form.[170] Since non-composite substances lack matter, Aristotle argues, they cannot be the result of matter taking on a form, and so they cannot come into being.[171] By the same token, they cannot go out of being, because that would be for their underlying matter to lose that form.[172] Instead, they exist only in actuality.[173] As with incomposites, Aristotle claims, we cannot be in error about them because we either correctly think of them as they are, or we fail to think of them at all.[174]

Aristotle is not here *identifying* incomposites with non-composite substances,[175] rather

167. I will not consider here the possibility that Aristotle takes the principles of one fundamental science ground those of all others. Such a reading is defended in Irwin (1988), but Aristotle's strong commitment to the autonomy of the sciences appears to rule this out: See *Post. An.* I.32, especially 88a.18–19.

168. *Met.* Θ.10, 1051b.25–26.

169. ἔκ τινος, *Met.* Θ.10, 1051b.30.

170. See e.g. *Met.* Z.7, 1032a.12–14.

171. Cf. *Met.* Z.15, 1039b.23.

172. Cf. *Met.* Z.15, 1039b.23–27.

173. *Met.* Θ.10, 1051b.28.

174. *Met.* Θ.10, 1051b.31–32.

175. Cf. Oehler (1962, 29:222), Seidl (1971, 182), Reeve (2016, 477–78).

he is drawing a comparison with them in respect of their imperishability and inability to exist in potentiality. Nevertheless, the comparison suggests that incomposites are also imperishable. But this is not the only way to take the analogy. The focus of Aristotle's analogy might instead be the absence of error in the case of non-composite substances. Aristotle's remark about the fact that non-composite substances do not perish may then be read as an explanation of why there is no error regarding them. There is no error regarding incomposites because they exist only in actuality, so any error to think of the object correctly would not be a thought of that object in some other potential state; it would just be a thought of something different. But that does not mean that instances of incomposite kinds must likewise be imperishable.

Aristotle also makes a comparison, as noted, with things "without change,"[176] where his example is an object of geometry (a triangle).[177] The type of error that someone might make regarding the angle sum of a triangle, Aristotle holds, is not that one might think it is *sometimes* 2R and *sometimes* not.[178] If someone grasps the concept of a triangle at all, they know that a triangle is not the type of thing subject to changes. The sort of error someone *could* make about a triangle is rather that *some* triangles have 2R where others don't.[179] That is, someone upon constructing an equilateral triangle and finding its angle sum to be 2R may think incorrectly that it is an idiosyncrasy of equilateral triangles that they have this angle sum. But no sane mathematician would think that triangles might have 2R today, but not tomorrow.

Here again, the fact that incomposites are compared with a certain type of object need not be taken to imply that they have the features of that object. While Aristotle's comparison could suggest that incomposites are incapable of change, he may also again

176. ἀκίνητα, *Met.* Θ.10, 1052a.4.

177. *Met.* Θ.10, 1052a.5.

178. *Met.* Θ.10, 1052a.5–7.

179. *Met.* Θ.10, 1052a.8.

mean to point out only that the type of errors possible regarding incomposites are limited in an analogous way. Anyone who grasps the definition of a triangle understands that triangles are not the types of things whose changes a scientist must take into account.[180] Likewise, anyone who grasps an incomposite understands that these are not the types of things whose definition might be the subject of further explication. As a grasp of a triangle makes clear that triangles never change, so too a grasp of the definition of incomposites makes clear that such definitions are immediate.

In this case, we need not take Aristotle to be restricting the incomposites to a particular type of science. Incomposites may be the primitive kinds posited by any science. Truths concerning incomposites are those *per se* truths that are necessitated by the existence of the subject genus and one of those primitive kinds. In so far as natural sciences also posit the existence of kinds whose existence is not subject to further explanation, there will be incomposite objects in the natural sciences as well.

That is, while the statement

A certain noise emanates from a cloud

does not correspond to the existence of an incomposite entity (because it can be proven), Aristotle takes the premises of these syllogisms to be, or be derivable from, *immediate* principles.[181] That implies that the *per se*$_2$ predications

Fire being extinguished is (or makes) a certain noise, and

Clouds are such as to have fire extinguished in them

will either correspond to the existence of incomposite objects, or they in turn will be provable from premises that ultimately correspond to incomposite objects. Aristotle does

180. Cf. *Phys.* II.2, 193b.31–35.

181. *Post. An.* I.10, 94a.9–10.

not give names to whatever objects correspond to these two predications (supposing they are immediate), but the first is perhaps the condition for the existence of the noise of fire-extinction in a cloud; the second the name for the type of moisture that constitutes clouds.[182] Assuming that these cannot be themselves demonstrated (and so the existence of these objects cannot be proven), these things will be counted as incomposite objects.

I will take up these issues again at the end of the next chapter. It is also instructive to consider how this theory relates to the types of necessities in nature discussed in the previous chapter. There I considered Aristotle's remarks about the *per se* necessities that are connected with fire and blood. In the passages we discussed, Aristotle treated it as an open question whether fire exists as the presence of heat in either smoke or of charcoal, the difference being that smoke is hot *in itself* while charcoal is not. This example need not be taken as a scientifically serious one, but it is illustrative of some interesting points. If fire is the presence of heat in charcoal, then the statement that fire is hot will be provable just in case it can be proven that charcoal is (sometimes) heated. On the other hand, if fire is the presence of heat in smoke, then the existence of fire will be provable just in case there turns out to be some explanation for why smoke is always hot. In either case, fire may or may not count as an incomposite object, but the relevant scientific necessity will be provable on the basis of some immediate predication corresponding to the existence of a subject. It is a significant advantage of this reading that it allows the possibility of particular predications to be immediate, thus leaving room for the possibility that the existence of fire only corresponds to a partial predication of its underlying subject (in the case that it is charcoal).[183]

None of this is to say, of course, that there are no significant differences between the status of necessities grounded in the incomposites in natural science and mathematics.

182. Cf. *Meteor.* I.3, 340a.30–340b.3. But see note 118 on p. 165.

183. Cf. *Post. An.* II.2, 90a.1–2, *Post. An.* II.8, 93a.12.

Although he probably takes there to be natural incomposite objects, Aristotle does not seem to think that they play exactly the same role as they do in mathematical sciences. To see more precisely how such necessities figure in Aristotle's theory, we must consider his views about what is distinctive about the necessities studied in nature. I turn to this in the next and final chapter.

## 4.6 Appendix: The role of the Principle of Non-Contradiction in demonstration

The demonstration which is sometimes seen as employing the Principle of Non-Contradiction (PNC) as a premise is given in *Posterior Analytics* I.11, in a passage discussing the role of this principle in demonstration:

> **T59** No demonstration assumes that it is impossible to simultaneously assert and deny except if a conclusion like that needs to be proven. It is shown by assuming that the first is true of the middle and that it is not true to deny it. It makes no difference that the middle is assumed to be and not to be, and likewise with the third. For if that of which it is true to say human is given, then, even if it is also true to say that it is not a human, so long as man is an animal and not not an animal, it will be true to say that Callias is an animal and not not-an-animal (even if this does not hold for that which is not Callias). The reason is that the first is not only said of the middle but also of something else since it applies to many, with the result that even if the middle is both itself and not itself, this will make no difference to the conclusion.[184]

Aristotle's description of the role of the PNC here is difficult to interpret, and the details have been subject to some debate. Thankfully, the issue which here concerns us is among the clearer points made in this passage. Aristotle claims that the law of non-contradiction is assumed only in demonstrations where the conclusion also is "like that."[185] Most commentators agree broadly on what Aristotle means: The PNC is only used in demonstrations whose conclusions are of the form "it is not the case that $p$ and not-$p$" or

184. τὸ δὲ μὴ ἐνδέχεσθαι ἅμα φάναι καὶ ἀποφάναι οὐδεμία λαμβάνει ἀπόδειξις, ἀλλ' ἢ ἐὰν δέῃ δεῖξαι καὶ τὸ συμπέρασμα οὕτως. δείκνυται δὲ λαβοῦσι τὸ πρῶτον κατὰ τοῦ μέσου, ὅτι ἀληθές, ἀποφάναι δ' οὐκ ἀληθές. τὸ δὲ μέσον οὐδὲν διαφέρει εἶναι καὶ μὴ εἶναι λαβεῖν, ὡς δ' αὕτως καὶ τὸ τρίτον. εἰ γὰρ ἐδόθη, καθ' οὗ ἄνθρωπον ἀληθὲς εἰπεῖν, εἰ καὶ μὴ ἄνθρωπον ἀληθές, ἀλλ' εἰ μόνον ἄνθρωπον ζῷον εἶναι, μὴ ζῷον δὲ μή, ἔσται [γὰρ] ἀληθὲς εἰπεῖν Καλλίαν, εἰ καὶ μὴ Καλλίαν, ὅμως ζῷον, μὴ ζῷον δ' οὔ. αἴτιον δ' ὅτι τὸ πρῶτον οὐ μόνον κατὰ τοῦ μέσου λέγεται ἀλλὰ καὶ κατ' ἄλλου διὰ τὸ εἶναι ἐπὶ πλειόνων, ὥστ' οὐδ' εἰ τὸ μέσον καὶ αὐτό ἐστι καὶ μὴ αὐτό, πρὸς τὸ συμπέρασμα οὐδὲν διαφέρει, *Post. An.* I.10, 77a.10–21.

185. οὕτως, *Post. An.* I.11, 77a.12.

(perhaps) "it is not the case that it is true to both affirm $p$ and to deny $p$."[186] Aristotle describes in the second sentence how the PNC enters into such demonstration when he says "it is shown by assuming that the first is true of the middle and that it is not true to deny it." The details of Aristotle's argument are difficult to reconstruct with any certainty, but McKirahan suggests:

1. Animal is said of all human and not (not-animal is said of all human),
2. Human is said of Callias and not (not-human is said of Callias),
3. So, animal is said of Callais and not (not-animal is said of Callias)[187]

Contrary to what McKirahan's commentary suggests,[188] this demonstration does not use the PNC as a premise, and nor does Aristotle claim this. Instead, Aristotle seems to be saying that the PNC is what *licenses* the two premises. The major premise is true because it can be derived from the PNC via repeated instantiation. Here the PNC functions as a rule that allows us to take a true predication AaB and generate a premise of the form:

AaB and not-[{not-A}aB]

The general principle, namely that it is impossible to assert and deny the same thing of something,[189] does not appear among these premises, and it is not clear how it could

186. See Husik (1906), McKirahan (1992, 76–79), Barnes (1993, 140–42), Mignucci (1975, 221–40), Detel (1993, 2:248–50).

187. McKirahan (1992, 76–79). Following McKirahan, I asssume that Aristotle is treating "Human is said of Callias" as a universal predication. Barnes (1993, 146) shares McKirahan's interpretation of the major, but takes the minor premise to be "human is said of all Callias," and the conclusion "not (animal is said of Callias and not-animal is said of Callias)." But he admits that he is then "unable to construct a valid line of syllogistic reasoning" from these premises to the conclusion (Barnes 1993, 146). Both interpretations make no attempt to present the premises in subject-predicate form, as Aristotle usually requires of demonstrative premises.

188. McKirahan (1992, 77).

189. *Post. An.* I.11, 77a.10.

ground them in syllogistic logic. The Principle of Non-Contradiction functions rather more like a rule of inference than what we in modern jargon would call an axiom. Aristotle treats it as a general schema that may be fed a true predication to yield a complex demonstrative premise. His point is that we only employ this type of rule when we are in the business of proving something of the form "AaB and not-[{not-A}aB]." This passage therefore provides no evidence that Aristotle admits common principles themselves as demonstrative premises.

# CHAPTER 5

# NECESSITY AND OUR KNOWLEDGE OF NATURE

I began this dissertation by asking how Aristotle can hold that the only things we know are necessary, given his radical view of the value of studying the perishable realm. In the previous chapters, I have explored how Aristotle argues for his position and what he takes it to entail. I have already flagged a number of places where a proper understanding of Aristotle's position shows that it raises fewer problems for empirical science than one might think. It is to knowledge as a durable state (*hexis*) that his claims about the necessity of its object apply.[1] The fact that knowledge is of the universal and necessary does not rule out knowledge of kinds with perishable instances; it only means that our knowledge of them *strictu sensu* is limited to the features these instances have *qua* instances of the relevant kinds.[2] Further, Aristotle's demonstrative theory allows him to view intermittently occurring phenomena like the lunar eclipse as necessities despite the fact that they do not occur constantly.[3]

Yet the natural sciences study not only necessarily occurrent properties of perishable individuals and regularly occurring phenomena like the eclipse. They also study phenomena that may seem to be contingent in a more straightforward way. The science of biology, for instance, has as one of its principal tasks to enumerate the parts that naturally belong to an animal. Yet animals do not always have their natural parts, as Aristotle observes:

> **T60** Sometimes animals are born with too many toes, sometimes with one alone, and so on with other parts, for they may be multiplied or they may be mutilated.[4]

1. See sections 2.1.2–2.2.

2. See section 3.3.4.

3. See section 3.4.2.

4. γίγνεται γὰρ ἐνίοτε τὰ μὲν πλείους ἔχοντα δακτύλους τὰ δ' ἕνα μόνον, καὶ περὶ τὰ ἄλλα μέρη τὸν αὐτὸν τρόπον· καὶ γὰρ πλεονάζει καὶ κολοβὰ γίγνεται, *Gen. An.* IV.4, 770b.30–33. Trans. Platt.

Animals may suffer birth defects: They may be born with parts lacking, in excess, or deformed. In addition to animals born with defects, Aristotle surely had experience of people and other animals that had parts missing or deformed due to their having been crippled, maimed or operated on in life. Aristotle gives no indication that he thinks an animal with one too many toes is not really an animal of that species, and it would be a disturbing result if he did. So Aristotle cannot rely on the fact that necessities only hold of individuals in so far as they exist as members of their kind. And Aristotle also does not think of this type of deformity as a regular occurrence like the eclipse. The science of zoology must tolerate the fact that individuals are sometimes exceptional.

What is even more unsettling, Aristotle sometimes also considers biological exceptions at the level of entire classes or kinds.[5] For instance, it is essential to birds, for Aristotle, that they are able to fly: The capacity for flight[6] is predicated "in the essence of bird."[7] Yet Aristotle classifies domestic fowl and similar animals as birds, despite being "not capable of flight."[8] Aristotle also takes it to be the "nature" of both male and female deer to bear horns,[9] despite the fact that female deer do not have horns.[10] And Aristotle draws special attention to the case of the blind mole: The mole belongs to the genus of footed live-bearing animals (vivipara),[11] and Aristotle takes the capacity for sight,[12] along with the other four senses,[13] to be an essential attribute of this genus. Yet he singles out the

5. My presentation of these cases follows Sandstad (2016a, 73–78).

6. τὸ πτητικόν, *Part. An.* IV.12, 693b.13.

7. τῷ δ' ὄρνιθι ἐν τῇ οὐσίᾳ, *Part. An.* IV.12, 693b.12–13; cf. *In. An.* 15, 712b.24–29.

8. μὴ πτητικά, *Part. An.* II.13, 657b.28. He also seriously entertains the classification of the Libyan ostrich as a bird in spite the fact that it is flightless in *Part. An.* IV.14, but his considered opinion on its classification is less clear: See Charles (2000, 316–26).

9. *Part. An.* III.2, 664a.5.

10. *Part. An.* III.2, 664a.3–4. Cf. *Part. An.* III.1, 661b.32–662a.2.

11. τὰ ζωοτόκα καὶ πεζά, *Hist. An.* IV.8.

12. ὄψις, *Hist. An.* IV.8, 532b.32.

13. *Hist. An.* IV.8, 532b.32–33.

blind mole as an exception, which "lacks the capacity for sight"[14] on account of its being "stunted."[15]

In light of such passages, some scholars have concluded that Aristotle either gives up the claim that what we know in the natural sciences is true of necessity,[16] or that he all but gives it up, by holding that what is true "for the most part" is close enough to count as a "necessity" in the context of natural science.[17] Yet Aristotle insists that there is "a type of demonstration and a type of necessity" that pertains to the study of animals.[18] and as Lennox points out, Aristotle's methodological discussion in *Parts of Animals* I.1 "is concerned to extend necessity beyond the *eternal* objects, where everyone from Democritus to Plato agreed it applies, to the realm of *generated* things. Necessity, Aristotle insists, is in fact (or also!) present here."[19]

I argue that Aristotle has the conceptual resources to make good this claim, in so far as he can explain how each of these types of exception is compatible with the necessity (in the full sense of what cannot be otherwise) of natural scientific truths. I will show this by means of an analysis of Aristotle's own discussion of the role played by necessity in natural

14. ὄψιν οὐκ ἔχει, *Hist. An.* IV.8, 533a.2.

15. *Hist. An.* IV.8, 553a.1.

16. See especially Lloyd (1990, 22), who infers from Aristotle's mention of "laxer" (μαλακώτερον) demonstrations at *Met.* E.1, 1025b.13 that demonstrations in natural science "need not meet the condition set out in APo. I 4 that demonstration is confined to what is necessary." Likewise, Sandstad (2016b) claims that essential properties in biology and chemistry need not hold of necessity. But both Lloyd and Sandstad still take demonstrations to prove non-incidental features; yet Aristotle argues in *Posterior Analytics* I.4–6 that whatever is non-incidental is in some sense necessary (*Post. An.* I.4, 73b.4–5, 11, 74b.11–12).

17. Thus Reeve (2000, 32) introduces a notion of "snessitation [sic]" to capture what he takes to be Aristotle's view that holding for the most part is a form of necessity without being "unqualified necessity" (Reeve 2000, 27, 30).

18. τρόπος τῆς ἀποδείξεως καὶ τῆς ἀνάγκης, *Part. An.* I.1, 640a.1. Cf. Lennox (2001, 128): "one thing is clear–there *is* a mode of demonstration and of necessity appropriate to the natural sciences."

19. Lennox (2001, 128).

sciences, beginning with his methodological remarks on biology in *Parts of Animals* I.1 and *Physics* II.9. First, however, I will consider a particularly developed version of the standard type of reconciliation offered on Aristotle's behalf by Mariska Leunissen, and say why I take this to be inadequate.

## 5.1 Leunissen on necessity and teleology

Mariska Leunissen provides one of the most developed accounts of what Aristotle means when he says that a type of necessity pertains to the natural sciences. She focuses, as I will, on the case of zoology. On Leunissen's reading, zoology studies two types of teleology. There is, firstly, what Leunissen calls "primary teleology," which concerns the way that an animal must be or develop in order to actualize its form.[20] The second, which she calls "secondary teleology," concerns the ways that an animal makes the best possible use of the material in which its form is being realized so as to facilitate the realization of its form.[21]

Correlated with these two types of teleology, Leunissen claims, are two kinds of causation, both of which Aristotle describes using the language of "necessity." The first is what she calls "conditional" necessity,[22] corresponding to Aristotle's locution, "necessity under a hypothesis."[23] When used to describe a causal process, this refers to the kind of causal necessitation operative in primary teleology, in which things come to be because they are necessary for some later end.[24] Aristotle's frequent example is the construction of a house: A foundation is necessary in order for there to be a house.[25] In such cases, the events

20. Leunissen (2010, 81–89).

21. Leunissen (2010, 89–99).

22. Leunissen (2010, 99).

23. E.g. *Part. An.* I.1, 639b.24, 642a.9.

24. Leunissen (2010, 102).

25. *Post. An.* II.12, 95b.32–37, *Gen. et Cor.* II.11, 337b.15, *Part. An.* III.5, 668a.16–19. Cf. *Met.* Δ.1, 1013a.5, *Rhet.* II.19, 1393a.8, *Phys.* VI.6, 237b.13.

which occur need not occur necessarily; it is a contingent fact that a foundation is laid down. Further, the laying down of a foundation does not necessarily bring about the end of the teleological process: It is possible for a foundation to be set down and a house never to be built. In such a case, we may thus not infer the presence of the teleological outcome from its precondition. Nevertheless, Leunissen holds, the preliminary stage (the laying down of bricks) causes the teleological outcome (the construction of a house), and, on this reading, Aristotle describes such a causal process as one of "necessitation" even though the outcome is not invariably produced by its causal antecedent.[26]

The second type of necessity, which Leunissen takes to characterize the causality of secondary teleology, is what she calls "material" necessity.[27] This type of necessity refers to the necessity of some outcome in a developmental process being due to the character of the matter in which that developmental process takes place.[28] Leunissen takes the solidification of water into ice upon the complete cessation of heat to be an example of such a causal process.[29] The transformation of liquid water into ice takes place on account of water's material nature: Water is the kind of material that tends to solidify when heat is removed. Nevertheless, at least in the sublunary realm such a causal process does not invariably terminate in its effect, according to Leunissen. We may, on her reading, only infer that ice will be formed "*for the most part*" in a sample of water from which heat is

26. She holds that "[t]he direction of necessity here works from the (prior) necessitating causes to the effect" even though "the coming to be or presence of the prior does not always necessitate the coming to be or presence of the posterior." See Leunissen (2010, 102). Also Leunissen (2010, 107): "one should not think that the prior necessitates without exception the coming to be of the posterior, but rather acknowledge the fact that the prior is merely a necessary precondition of the posterior."

27. Leunissen (2010, 101–2).

28. Leunissen (2010, 101). Leunissen is here developing an argument due to Cooper (1987) that Aristotle's commitment to hypothetical necessity in nature and rejection of the Empedoclean explanatory paradigm does not exclude his recognition of matter operating by its own principles but rather presupposes it.

29. Leunissen (2010, 101).

completely removed, not that it will in every case.[30] Despite this, Leunissen claims, causal processes like these, where the connection is merely for-the-most-part, are enough to count as necessities in the context of biology and other natural sciences for Aristotle.

This is a surprising result, since Aristotle frequently glosses "necessary" with "cannot be otherwise." In elaborating his catalog of senses of necessity in *Metaphysics* Δ.5, he presents this meaning as the overarching sense, encompassing all of the others.[31] Further, on a number of occasions Aristotle explicitly *contrasts* necessity with being for the most part.[32] If "material" and "conditional" necessities are generic causal statements that are true in many but not all cases, then it is hard to see in what sense these are "necessary" at all. If Aristotle is simply extending the term "necessity" to cover, by approximation, truth for the most part, then the unity between the theory of scientific knowledge in the *Posterior Analytics*, which depends as we have seen on his arguments for scientific knowledge's necessity, and the theory of biological science given in *Parts of Animals* I is superficial indeed.

Aristotle does not in fact seem to think of the connection between terms in demonstrations concerning sublunary processes in the way Leunissen presents it. He treats the example she employs, the formation of ice, in *Posterior Analytics* II.12:

30. "Because material necessity does not always necessitate its effects in the sublunary realm, the inference we can draw on the basis of the presence of the cause in such rectilinear materially necessitated processes is that the effect will only come to be as well *for the most part*, but not that it always does" (Leunissen 2010, 101–2, Leunissen's emphasis).

31. *Met.* Δ.5, 1015a.33–36. See my discussion in section 4.1.

32. *Met.* E.3, 1027a.8–9.

**T61** What is ice? Let it be assumed that it is solidifed water. Let water be C, solidification A, and the cause, B, the total deprivation of heat. B holds of C, and being solidified, A, holds of B. Ice *comes to be* because B *comes about*, and ice *will have come about* when B *has come about*, and it *will come about* if B does. And so the cause and that of which it is the cause come about at the same time, whenever they come about, and it is the case whenever the cause is, and likewise in the case of what will be and what has been.[33]

Aristotle here lays down a rule connecting demonstrations with their tensed variants. If there is a demonstration in the first figure with terms A, B, and C, then we may replace the terms with tensed variants. So, if $B$ is the middle term in a demonstration of for "$A$ is said of all $C$," then "what has come to be $B$" is the explanation for "what has come to be $A$ is said of what has come to be $C$," and "what will be $B$" is a middle for "what will be $A$ is said of all of what will be $C$," etc. His point in this passage is that such *uniform* tensing of terms in no way alters the logic of demonstrations: While the tensed variants still do not count as strict demonstrations (just because its conclusion is not a time-general proposition),[34] they are necessitated by their premises in exactly the same way as in the original demonstration. *If* ice will be totally deprived of heat tomorrow, then it will *necessarily* become frozen tomorrow, since to be ice just *is* (in this example) to be water whose heat has been removed entirely. Problems only arise when we tense terms non-uniformly.[35] We cannot reason, Aristotle says, from the fact that water is *currently* being deprived of heat to the fact that *tomorrow* it will be frozen. But that is just because the presence of the cause now (deprivation of heat) does not guarantee its presence tomorrow

33. τί ἐστι κρύσταλλος; εἰλήφθω δὴ ὅτι ὕδωρ πεπηγός. ὕδωρ ἐφ' οὗ Γ, πεπηγὸς ἐφ' οὗ Α, αἴτιον τὸ μέσον ἐφ' οὗ Β, ἔκλειψις θερμοῦ παντελής. ὑπάρχει δὴ τῷ Γ τὸ Β, τούτῳ δὲ τὸ πεπηγέναι τὸ ἐφ' οὗ Α. γίνεται δὲ κρύσταλλος γινομένου τοῦ Β, γεγένηται δὲ γεγενημένου, ἔσται δ' ἐσομένου. Τὸ μὲν οὖν οὕτως αἴτιον καὶ οὗ αἴτιον ἅμα γίνεται, ὅταν γίνηται, καὶ ἔστιν, ὅταν ᾖ· καὶ ἐπὶ τοῦ γεγονέναι καὶ ἔσεσθαι ὡσαύτως, *Post. An.* II.12, 95a.14–21.

34. Cf. *Post. An.* I.31, 87b.30–39.

35. *Post. An.* II.12, 95a.36–95b.1.

as well. The water may have heated up in the mean time.[36]

Aristotle's position, here at least, is therefore not, as Leunissen says, that the cause of a sublunary process like ice-formation brings about its effect only for the most part. As in any science, the presence of the cause *necessitates* the presence of the effect. The total deprivation of heat brings about the freezing of water because there is nothing else required for something to be frozen water than for it to be water with the heat removed, just as there is nothing required for a shape to have 2R apart from it being a triangle. We cannot infer from the presence of the cause now to the presence of the effect later, but that is not because the cause is insufficient for the effect; it is because the causes of sublunary phenomena (unlike the causes of angle sums in triangles) are not always present. Aristotle's position is not that there is some lax demonstration or quasi-necessity connecting the present causes to future effects; his position is that there is none at all in the sublunary realm.[37]

None of this is to deny, however, that Aristotle does see a special connection between natural phenomena and truth for the most part. In order to better see how Aristotle is attempting to reconcile his claim that what we know is a necessity with his association of truth for the most part with natural science, let us turn to Aristotle's own remarks on the role of necessity in natural science.

## 5.2 Aristotle on necessity in nature: *Parts of Animals* I.1

Aristotle elaborates on the type of necessity that exists in nature in *Parts of Animals* I.1, and closely allied passages in *Physics* II.8–9 and *Generation and Corruption* II.11. Aristotle distinguishes two types of necessity that pertain to natural things:

36. *Post. An.* II.12, 95b.1.

37. Cyclical phenomena, however, constitute a special case for Aristotle: See *Post. An.* II.12, 95b.38–96a.19 and *Gen. et Cor.* II.11. I will not discuss these here.

**T62** Necessity does not pertain to natural things in the same way, yet nearly everyone tries to refer their accounts back to it without having first distinguished in how many ways the necessary is said. Unconditional necessity pertains to eternal things, but hypothetical necessity pertains to those things which undergo generation, just as with artifacts, for example with a house or any such thing. It is necessary for there to be this matter, if a house or any other such goal is to be: And this thing must change or be generated first, then this, and so on in this manner until the goal or that for the sake of which is achieved. Similarly with everything that comes about by nature.[38]

In any natural science, Aristotle holds, the objects of study change, and it is the task of the scientist to understand these changes. In sublunary nature, objects not only change but also come into being, and the scientist must additionally comprehend the processes of their generation.[39] Here I will focus on Aristotle's account of necessity in sublunary nature, and in particular in the study of animals, since this is both where we have the most material and also where the gravest doubts regarding the tenability of Aristotle's claim that scientific knowledge is of necessities tends to arise.

The fact that sublunary individuals may perish means that a demonstration may not take their presence for granted. While a feature demonstrated from what it is to be the moon will always correspond to a true fact about the moon (since the moon always exists), a feature demonstrated on the basis of what it is to be, say, Cuttie the cuttlefish will not always correspond to a true statement about Cuttie, since Cuttie may perish and the truth about him thus become false. Nevertheless, it is possible to state true "hypothetical"

38. Τὸ δ' ἐξ ἀνάγκης οὐ πᾶσιν ὑπάρχει τοῖς κατὰ φύσιν ὁμοίως, εἰς ὃ πειρῶνται πάντες σχεδὸν τοὺς λόγους ἀνάγειν, οὐ διελόμενοι ποσαχῶς λέγεται τὸ ἀναγκαῖον. Ὑπάρχει δὲ τὸ μὲν ἁπλῶς τοῖς ἀϊδίοις, τὸ δ' ἐξ ὑποθέσεως καὶ τοῖς ἐν γενέσει πᾶσιν, ὥσπερ ἐν τοῖς τεχναστοῖς, οἷον οἰκίᾳ καὶ τῶν ἄλλων ὁτῳοῦν τῶν τοιούτων. Ἀνάγκη δὲ τοιάνδε τὴν ὕλην ὑπάρξαι, εἰ ἔσται οἰκία ἢ ἄλλο τι τέλος· καὶ γενέσθαι τε καὶ κινηθῆναι δεῖ τόδε πρῶτον, εἶτα τόδε, καὶ τοῦτον δὴ τὸν τρόπον ἐφεξῆς μέχρι τοῦ τέλους καὶ οὗ ἕνεκα γίνεται ἕκαστον καὶ ἔστιν. Ὡσαύτως δὲ καὶ ἐν τοῖς φύσει γιγνομένοις, *Part. An.* I.1, 639b.21–30.

39. My reading here agrees with that of Leunissen (2010, 106). Gotthelf and Balme (1992, 170–71) takes the contrast to be between mathematics and natural science; but the context rules this out, as Leunissen points out.

necessities about a cuttlefish like Cuttie. Working from the "hypothesis" that an individual like Cuttie does exist, we may deduce things about how Cuttie must have come about or what properties Cuttie must, as a cuttlefish, presently have.

Aristotle compares this type of necessity to the way that we may reason about artifacts. The presence of a foundation for a house does not guarantee its construction, just like the presence of Cuttie now does not guarantee that there will be a live mollusk in this lake tomorrow. Nevertheless, given that there is now a live cuttlefish in this lake, we may infer with necessity that Cuttie underwent a process of generation, and that he presently has all that is required for a cuttlefish to live.

Aristotle also compares this to the way in which we call food a "necessity" of life: Food is "necessary" in the sense that life *requires* it, and thus in the sense that there must be food if there are to be living creatures; not, however, in the sense that there must be food *simpliciter*. He elaborates on how this type of necessity features in biology using the metaphor of an axe:

> **T63** For food is said to be a necessity [...] because existence is not possible without it. It is, as it were, necessary on a hypothesis. For just as, since the axe must split, it is a necessity that it be hard, and if hard, then made of bronze or iron, so too since the body is an instrument (for each of the parts is for the sake of something, and likewise also the whole), it is therefore a necessity that it be of such a character and constituted from such things, if that is to be.[40]

Even if one cannot demonstrate the existence of a certain axe, one can demonstrate that *if this axe exists*, it must have certain properties and material features. It is possible, in turn, to demonstrate that such properties necessitate the axe being made of a certain

40. λέγομεν γὰρ τὴν τροφὴν ἀναγκαῖόν [...] ὅτι οὐχ οἷόν τ' ἄνευ ταύτης εἶναι. Τοῦτο δ' ἐστὶν ὥσπερ ἐξ ὑποθέσεως· ὥσπερ γὰρ ἐπεὶ δεῖ σχίζειν τῷ πελέκει, ἀνάγκη σκληρὸν εἶναι, εἰ δὲ σκληρόν, χαλκοῦν ἢ σιδηροῦν, οὕτως καὶ ἐπεὶ τὸ σῶμα ὄργανον (ἕνεκά τινος γὰρ ἕκαστον τῶν μορίων, ὁμοίως δὲ καὶ τὸ ὅλον), ἀνάγκη ἄρα τοιονδὶ εἶναι καὶ ἐκ τοιωνδί, εἰ ἐκεῖνο ἔσται, *Part. An.* I.1, 642a.7–12.

type of material: Something hard enough for the axe to perform its splitting function. An axe is essentially a splitting tool, and so it could not *be* an axe without being capable of splitting, but this necessitates it being hard, and this in turn necessitates it being made of a hard material like bronze or iron. Just as an axe is, for the sake of this example, taken to be defined as a splitting tool, so too an animal is to be defined in terms of its function: In terms of the specific ends that characterize that type of animal's life.[41] On the basis of these, the natural scientist deduces that this type of animal must have certain parts and properties. And on the basis of this, she may be able to deduce facts about the physical constitution of particular animals, under the (undemonstrated) hypothesis that the animal is alive.

Hypothetical necessity is thus, as Cooper points out, genuinely a form of necessity.[42] Something is hypothetically necessary only if the existence of an entity with the goals in question leaves only a specific, well-demarcated possibility for its composition, development or character.[43] This is a demanding condition: Hypothetical necessities, as Aristotle conceives them here, will not include things that pertain to an animal merely because they aid it in achieving its goals or help it live well.[44] They include only the *sine qua non* of an animal's life.[45] Thus if it is true, as Aristotle thought, that an animal cannot live without a heart or a stomach, but it can live without kidneys (which merely help in filtering the blood), then only the heart and stomach are hypothetically necessitated.[46] Since an animal *could* live without kidneys, this fails to count as hypothetically necessary.

Nevertheless, Aristotle takes it to be a task of the study of animals to explain why

41. Cf. Lennox (2010).
42. Cooper (1987, 256).
43. Cooper (1987, 256).
44. Cooper (1987, 256).
45. Cooper (1987, 254).
46. Cooper (1987, 256).

animals have a kidney, even though they could live without one. He explicitly leaves room for this type of explanation:

> **T64** Hence it would be best to say that, since this is what it is to be a human being, on account of this it has these things; for it cannot be without these parts. If one cannot say this, one should say the next best thing, i.e., either that in general it cannot be otherwise, or that at least it is good thus.[47]

Although Aristotle avoids calling these "second best" explanations hypothetical necessities, they may be thought to follow essentially the same pattern, only in this case we reason not from the hypothesis that some thing of that kind exists, but that it exists in such a way that allows it to felicitously achieve its goals. Aristotle gives two ways of describing the second-best type of explanation. On the one hand, we may think of the content of such an explanation as the fact that something could not *generally* be otherwise even if it is not in every case. That is, even if it is possible for a particular person not to have a kidney, it would not be feasible for humans to generally live without kidneys. Only the special circumstances of that individual make it possible. But we may also, Aristotle says, think of the content of the explanation as being what is *good* for the animal in question: We can explain why it must necessarily be a good thing for humans to have kidneys.

Aristotle compares what is necessary for a good end to necessities like "food" in *Metaphysics* Δ.5:

47. Διὸ μάλιστα μὲν λεκτέον ὡς ἐπειδὴ τοῦτ' ἦν τὸ ἀνθρώπῳ εἶναι, διὰ τοῦτο ταῦτ' ἔχει· οὐ γὰρ ἐνδέχεται εἶναι ἄνευ τῶν μορίων τούτων. Εἰ δὲ μή, ὅτι ἐγγύτατα τούτου, καὶ ἢ ὅλως (ὅτι ἀδύνατον ἄλλως) ἢ καλῶς γε οὕτως, *Part. An.* I.1, 640a.33–640b.1. Trans. Lennox.

**T65** The term "necessity" applies to that without which something cannot live, as a contributing cause (for example breathing and food are necessary for an animal, because an animal cannot exist without these), and also that without which the good is not able to be or to come about, or that without which some bad is not able to be avoided or negated (for example drinking the medicine is necessary so that one will not be sick, and sailing to Aigina is necessary so as to obtain some goods).[48]

Closely allied to necessities of life like food and breathing are necessities for the achievement of certain goods or avoidance of certain ills. These are what underlie the "second best" explanations Aristotle describes in T64. Such necessities have essentially the same structure as the first kind, except that we replace the assumption that an animal of the relevant kind simply exists (i.e., manages to live) with the assumption that one achieves what is good for it. That is, the student of nature will explain why an animal has such parts as kidneys by *assuming* that an animal achieves not only its bare existence but a full life: Its *kalon*. Aristotle's claim in T64 that the second-best explanation shows that the things required for an animal's good "follow" suggests that these will be likewise strictly necessary under the appropriate assumptions. If the animal is to live well as a member of its kind, it *must* be, have, or be made out of such-and-such, or must develop in a certain way, etc.

There are therefore two classes of strict necessities which a biological science studies. First, there are the "hypothetical necessities" concerning what must be true of a natural being in order to exist at all. Second, there are things that must be true of a natural being if it is to felicitously achieve its end; in the case of biology, if it is not only to live but to live well. In sum, then, the necessary truths of natural sciences are of the form:

1. If a thing with goal G is to *exist at all*, it must be F, and

48. Ἀναγκαῖον λέγεται οὗ ἄνευ οὐκ ἐνδέχεται ζῆν ὡς συναιτίου (οἷον τὸ ἀναπνεῖν καὶ ἡ τροφὴ τῷ ζώῳ ἀναγκαῖον, ἀδύνατον γὰρ ἄνευ τούτων εἶναι), καὶ ὧν ἄνευ τὸ ἀγαθὸν μὴ ἐνδέχεται ἢ εἶναι ἢ γενέσθαι, ἢ τὸ κακὸν ἀποβαλεῖν ἢ στερηθῆναι (οἷον τὸ πιεῖν τὸ φάρμακον ἀναγκαῖον ἵνα μὴ κάμνῃ, καὶ τὸ πλεῦσαι εἰς Αἴγιναν ἵνα ἀπολάβῃ τὰ χρήματα), *Met.* Δ.5, 1015a.20–26.

2. If a thing with goal G is to *achieve its good*, it must be F.

Aristotle takes necessities of the second form to be coincide with what is necessary for things with goal G "in general,"[49] even if not in every case. Implicit here is the idea that a kind of animal cannot *consistently* fail to achieve its ends. Something would not count as a goal-directed kind if its members did not regularly achieve these goals, even if not every instance of the species does.

Thus we must distinguish carefully the necessities associated with a biological *kind* and those associated with biological *individuals*. If the goal of Ks is to G, then Aristotle holds it to be *necessary* that Ks generally achieve the goal G. But that does not imply either that every K achieves this goal, or even that every *kind* of K does. It implies only that it would be a fine thing for these to achieve this goal.

All necessity in zoology is, then, dependent on the existence of animals with definable ends. But Aristotle distinguishes between those features that are necessitated by animals of the relevant kinds merely existing, and those which are necessitated by the animals of the relevant kinds both existing and living to achieve their ends. In calling the second type of explanation "second-best," Aristotle means that such a truth is not guaranteed to hold of the individual, because it reflects the necessity of a generic truth about the animal's kind. This lends both hypothetical necessity and "second best" explanations an important connection with truth for the most part, for Aristotle, although the connection is not one of straight assimilation. Aristotle explains the connection between having a goal and achieving it as follows:

**T66** In all cases, we say that this is for the sake of that, whenever there seems to be some end to which the change proceeds if nothing prevents it.[50]

49. ὅλως, *Part. An.* I.1, 640a.36 (T64).

50. Πανταχοῦ δὲ λέγομεν τόδε τοῦδε ἕνεκα, ὅπου ἂν φαίνηται τέλος τι πρὸς ὃ ἡ κίνησις περαίνει μηδενὸς ἐμποδίζοντος, *Part. An.* I.1, 641b.23–25.

While a thing's having a goal does not guarantee that it achieves its goal, it does guarantee something weaker. It necessitates that the thing will achieve its goal if nothing prevents it. This is what it is, for Aristotle, for something to have a goal or nature. It is to be such that it engages in certain activities any failure to perform which must necessarily be referred to some interruption or prevention. To deny this, Aristotle thinks, would be to deprive the idea of nature of its point. What occurs by nature is not "any chance thing" but some regular, orderly sequence of events,[51] a sequence which, however, may be prevented from reaching its culmination in the sublunary world due to its taking place in an environment where other processes may interrupt or subvert it. Thus, if an acorn fails to grow into an oak, there must be some reason why it did; otherwise, Aristotle thinks, the statement that a seed naturally produces a plant would be no different from saying that it just *happened* to produce one – a consequence he takes to be absurd.[52]

Closely connected with hypothetical necessities, then, are necessities about natural things of the following form

> If it is the nature of some X to achieve G, then, necessarily, if X *fails* to achieve G, there is some factor that prevented X from achieving G.

Now, truth for the most part, for Aristotle, is not simply a statistical notion. That something occurs for the most part does not mean that it happens simply *in most cases*. Aristotle consistently distinguishes truth for the most part from what occurs by luck, chance or accident.[53] What occurs by coincidence occurs for a reason that is in no way explained by the natures of the subject that suffers the coincidental occurrence or the coincidental thing that befalls it.[54] What occurs for the most part is, by contrast, what

51. *Part. An.* I.1, 641b.27.

52. *Part. An.* I.1, 642a.1.

53. *Post. An.* I.30, 87b.19, *Gen. et Cor.* II.6, 333b.7, *De Cael.* I.12, 283a.33, *Eud. Eth.* VII.14, 1247a.32, *Met.* E.2, 1026b.27–33.

54. *Met.* E.2, 1026b.32–1027a.7.

occurs "on account of a thing's nature."[55] It follows that something is true for the most part if any failure to achieve its goal is necessarily the outcome of some hindrance. The force of the conditional here – that if any K fails to achieve G, there is something that prevented it – is clearly counterfactual: In *any possible* case in which nature fails to realize its goal, there must have been something that prevented it. Hence Aristotle is plausibly committed to the thesis that

1. Given that things of kind K have goal G, then it is *necessarily true* that Ks G *for the most part*.

In *this* sense, Aristotle does assimilate truth for the most part to necessity: If something is true for the most part, then it is *necessarily* true for the most part. But that must be sharply distinguished from the claim that Aristotle takes truth for the most part to itself be a type of necessity, which would imply that

2. If, for the most part, Ks G, then, necessarily, Ks G

While Aristotle plausibly does hold that truths for the most part *necessarily* hold for the most part, he does not hold that truth for the most part is itself a *kind* of necessity, in the sense that would license a principle of this form.

## 5.3 Truth for the most part as interrupted necessity: *Prior Analytics* I.13

There is a further connection of truth for the most part with necessity implicit in this account, which Aristotle draws out in *Prior Analytics* I.13. *Prior Analytics* I.13 marks the

55. τὸ κατὰ φύσιν ἐστὶ τὸ ὡς ἐπὶ τὸ πολύ, *Gen. An.* V.8, 777a.21–22. Cf. *Gen. An.* I.19, 727b.29–30, *Part. An.* III.2, 663b.28–29, *Met.* E.2, 1027a.8–28. See further Ferejohn (1991, 119–20).

beginning of Aristotle's *contingency syllogistic*, the chapters of the *Prior Analytics* where Aristotle extends his syllogistic logic to include propositions including the modal qualifier "possibly." Among propositions which are neither necessary nor impossible, Aristotle draws a distinction between two senses of "contingent."[56] In one sense, the second Aristotle delineates, to be contingent means to "come about by chance."[57] Aristotle illustrates this sense with the example of an animal walking or an animal experiencing an earthquake.[58] This is said to be contingent because there is no intrinsic connection between an animal walking, in general, and there being an earthquake, in general. While the two events on some occasion may *coincide*, it is neither the case that the animal's walking predisposed there to be an earthquake, nor that there being an earthquake predisposed the animal to walk. Aristotle takes this lack of any causal connection between walking in general and earthquakes in general to be one thing that is *meant* by calling something "contingent," namely that it is a sheer coincidence.

With such contingencies, which Aristotle labels "indeterminate," it is no more natural for the state of affairs to obtain than not to:[59] It is no more natural for there to be an earthquake while an animal walks than for there to be no earthquake while the animal walks. In another sense, however, Aristotle takes "to be possible" to mean "to be naturally predicated."[60] Here is what Aristotle says, on two translations:

56. τὸ ἐνδέχεσθαι, *Pr. An.* I.13, 32b.4.

57. *Pr. An.* I.13, 32b.12–13.

58. *Pr. An.* I.13, 32b.11–12.

59. *Pr. An.* I.13, 32b.17–18.

60. πεφυκὸς ὑπάρχειν, *Pr. An.* I.13, 32b.8.

**T67** One meaning is what happens for the most part and falls short of necessity, as for a man to turn gray or grow or shrink, or in general what is natural to belong (for this does not have continuous necessity because a man does not always exist; however, when there is a man, it is either of necessity or for the most part)[61]

> [...] in one way of what happens for the most part, when the necessity has gaps, such as that a man turns gray or grows or ages, or generally what belongs by nature. For this has no continuous necessity because a man does not exist forever, but while a man exists, it happens either of necessity or for the most part.[62]

Aristotle gives three examples here: A person growing, a person shrinking in old age, and a person developing grey hair. He focuses on the last of these, and explains in greater detail than he normally does what makes something a natural occurrence and thus what makes it hold for the most part. Such natural occurrences are not contingencies like the earthquake while an animal walks, which are no more natural than their opposites. Even though it is contingent for people to grow before they begin to shrink in old age, it is still not a *coincidence*, because it is "natural" that they do so. It would be unnatural, Aristotle might have added, for someone to first shrink and then grow in old age.

Aristotle goes on to claim that while there is no scientific knowledge or demonstrative syllogism of indeterminate contingencies, there is demonstration of contingencies of this kind, at least "roughly speaking:"[63]

61. ἕνα μὲν τὸ ὡς ἐπὶ τὸ πολὺ γίνεσθαι καὶ διαλείπειν τὸ ἀναγκαῖον, οἷον τὸ πολιοῦσθαι ἄνθρωπον ἢ τὸ αὐξάνεσθαι ἢ φθίνειν, ἢ ὅλως τὸ πεφυκὸς ὑπάρχειν (τοῦτο γὰρ οὐ συνεχὲς μὲν ἔχει τὸ ἀναγκαῖον διὰ τὸ μὴ ἀεὶ εἶναι ἄνθρωπον, ὄντος μέντοι ἀνθρώπου ἢ ἐξ ἀνάγκης ἢ ὡς ἐπὶ τὸ πολύ ἐστιν), *Pr. An.* I.13, 32b.5–10. Trans. Smith.

62. *Pr. An.* I.13, 32b.5–10. Trans. Striker.

63. σχεδὸν, *Pr. An.* I.13, 32b.20.

**T68** There is no knowledge or demonstrative syllogism of indeterminate [contingenicies] because the middle term is irregular, but roughly speaking there are inquiries and arguments about things that are contingent in this sense [sc., naturally][64]

What is clear in this passage, then, is that Aristotle does not take all contingencies to be sheer coincidences. Those that are not are "natural," true for the most part, and have some more significant connection with demonstration and demonstrative knowledge. What is less clear is how Aristotle takes natural contingency to be related to necessity, and whether, by claiming that there is "roughly speaking"[65] demonstrative knowledge of these, he is departing from his official theory on which demonstrative knowledge needs to be of necessities.

On Smith's translation of T67, which is reflective of the traditional interpretation of this passage,[66] there is such a departure. As Smith translates the passage, Aristotle claims flatly that natural possibilities are not necessities: They "fall short of necessity"[67] because they hold only for the most part. Nevertheless, Aristotle does claim on Smith's translation there can be scientific knowledge and demonstration of them owing to the fact that they are not coincidental, contradicting his frequent claims in the *Posterior Analytics* that necessity is of what cannot be otherwise.

This reading, however, makes it difficult to understand the remark that Smith translates as a parenthetical: "this does not have continuous necessity because a man does not always exist; however, when there is a man, it is either of necessity or for the most part."[68] That

64. ἐπιστήμη δὲ καὶ συλλογισμὸς ἀποδεικτικὸς τῶν μὲν ἀορίστων οὐκ ἔστι διὰ τὸ ἄτακτον εἶναι τὸ μέσον, τῶν δὲ πεφυκότων ἔστι, καὶ σχεδὸν οἱ λόγοι καὶ αἱ σκέψεις γίνονται περὶ τῶν οὕτως ἐνδεχομένων, *Pr. An.* I.13, 32b.18–22.

65. σχεδὸν, *Pr. An.* I.13, 32b.20.

66. Cf. Ross (1949, 326–30).

67. διαλείπειν τὸ ἀναγκαῖον, *Pr. An.* I.13, 32b.6.

68. *Pr. An.* I.13, 32b.7–10. τοῦτο γὰρ οὐ συνεχὲς μὲν ἔχει τὸ ἀναγκαῖον διὰ τὸ μὴ ἀεὶ εἶναι ἄνθρωπον, ὄντος μέντοι ἀνθρώπου ἢ ἐξ ἀνάγκης ἢ ὡς ἐπὶ τὸ πολύ ἐστιν. Trans. Smith.

is, in at least some cases, it *is* necessary that men go grey. It is necessary, namely, when a man grows to a sufficient age and when the man is not hindered from going grey by any other factors. Yet Aristotle has just told us that natural contingencies are not necessities, on Smith's translation. One possible reconciliation would be to say that it is contingent that *all* men go grey, but in those cases where they do, this is necessary. Yet this position is difficult to make sense of. If an individual occurrence is the outcome of a process that does not always bring about a result of that kind, it would be special pleading to insist that it *is* necessary in the cases where the outcome does occur. The only sense of necessity here is the trivial one that any fact is necessary given that fact obtains (that $p$ is necessary given $p$). On Aristotle's own view, as we have seen, there are necessities at the level of individuals only in those cases where they are reflective of a necessity at the level of some kind.[69] The view we must attribute to Aristotle on this reading is almost the opposite: That individual outcomes count as necessary even when there is no such necessity at the level of kinds.

Noting the difficulties faced by the standard interpretation of this passage, Gisela Striker defends a different interpretation of this passage, captured in her translation.[70] Striker hypothesizes that Aristotle first tried to treat exception-permitting natural occurrences as contingencies, but was troubled by the fact that these failed to display the same logic as chance occurrences, and that they seem to admit of scientific explanation, in contradiction of his official theory according to which only necessities may be objects of scientific knowledge. This passage, according to Striker, is Aristotle's attempt to assimilate natural occurrences to *necessities*. He does so by conceiving of them as necessities that may be "interrupted."[71] Where Smith takes Aristotle to be saying that simply denying that natural contingencies are necessities, Striker takes him to be affirming that they are

69. See section 3.3.4.

70. Striker (1985).

71. Striker (1985, 151).

necessities of a certain, "interrupted" or "gappy" sort.[72] What Aristotle means, according to Striker, is that a natural contingency is a type of necessity that only brings about its outcome when certain further conditions are met.[73] It is what we might today call a *ceteris paribus* law. A sentence like "men go grey" is "necessary" in the sense that men go grey so long as nothing prevents their greying.

This fits well with Aristotle's view that for-the-most-part predications hold in the absence of anything which prevents them from so holding. Striker's reading is also able to make better sense of the part of the text Smith construes as a parenthetical. On Striker's reading, Aristotle is delineating the two different ways that a natural contingency may be "interrupted," that is, two different types of defeaters for a *ceteris paribus* law. On the one hand, a given man may fail to go grey because he may not live until the age when men naturally go grey. Even if a man does go grey, however, there may be further interruptions to the process of greying which prevent it from occurring. To use Striker's example, the man may go bald before having a chance to go grey.[74] So, even if a man does not die prematurely, it may still be the case that he fails to go grey. But if he does not die prematurely, there is some other fact about his bodily processes that explains why he does not. If he does go grey, however, this is a manifestation of the "necessity" that all men go grey. This is why, even when the man does live into old age, he still only goes grey *either* of necessity or for the most part.

Aristotle's idea here, on Striker's reading, is thus that the original contingency is also a "necessity" because we can gather all of these possible "defeating conditions" into a single clause C. We may then say that

72. The disagreement is over the meaning of the word διαλείπειν at 32b.6, which Striker translates as "has gaps," Smith as "falls short."

73. Striker (1985, 159).

74. Striker (1985, 158).

Necessarily: Given that C does not occur, men go grey[75]

And it is in this sense that a natural contingency is a "necessity," albeit one with "gaps."

Despite these textual advantages, however, Striker's reading leaves Aristotle with a view that is scarcely tenable. For it is not clear why this does not render *all* contingency propositions into natural contingencies and thus necessities. Take Aristotle's example of an "indeterminate" contingency, an earthquake occurring while an animal walks. If all that is required for something to be a natural contingency is that there is *some* set of conditions absent whose occurrence that event necessarily occurs, then that will apparently hold in this case, too. For it is surely true that

Necessarily: Given that there does not fail to be an earthquake while this animal walks, there is an earthquake while this animal walks

Yet that gives us no grounds for counting this contingency as any non-trivial form of necessity. Perhaps this strategy could be saved by placing more restrictions on the permissible contents of the defeating conditions C. As it stands, however, Aristotle's attempt to assimilate natural contingencies to necessities, as Striker reads it, undermines the distinction he is attempting to make.[76]

However, I believe we can retain the kernel of Striker's idea without leading to this unpalatable consequence. Robert Kilwardby, a thirteenth-century Paris Master of Arts and prolific commentator on Aristotle's logical works, makes a useful distinction in his commentary on this passage.[77] He distinguishes between two senses of a predicate like

75. Striker (1985, 158).

76. A similar criticism may be made regarding the version of this principle defended in Winter (1997, 179). A proposal closer to the one I defend below is found in Mignucci (1981), who emphasizes the *actual* possession by the subject of a property that naturally manifests in the characteristic displayed for the most part.

77. *Notuli Libri Priorum.* An edition and translation has recently been completed by Paul Thom and John Scott (Kilwardby 2016).

"grey." On the one hand, this may be understood to denote the *process* of going grey.[78] "All men go grey" means, on this interpretation, that all men are *in the process* of going grey. On the other hand, the term "grey" may denote the *completion* of this process.[79] Under this interpretation, to say that all men go grey means that all men achieve the completed state of this the process of going grey: All men go grey and thus *actually become* grey.

Aristotle's point in T67, according to Kilwardby, is that a sentence describing a natural occurrence like "men go grey" is necessary on one of these readings and contingent on the other. If we understand "grey" to denote the achievement of the outcome of going grey, then the statement is false, for the reasons Aristotle describes: Men may die before they have a chance to go grey, or they may suffer other misfortunes, like hair loss, that prevent the process from ever reaching its natural end and manifesting its effect of grey hair.[80] Since such occurrences are the exception rather than the rule, it is still true that men actually go grey *for the most part*, but the sentence that men actually go grey is not a necessity, and consequently not a possible item of scientific knowledge. Yet if it is understood the other way, that men are always *in the process of going grey*, then it expresses a demonstrable necessity.[81] Kilwardby even gives a sketch of what he takes the relevant demonstration to be:

> For greyness comes from the incorporation of phlegm into the upper part of the head – which incorporation is caused by the diminution of natural heat, and this incorporation and diminution of heat is always going on without interruption.[82]

78. *motum*, L.18, 535 (dub. 8 sol.).

79. *terminum motus*, L.18, 535 (dub. 8 sol.).

80. L.18, 535–540 (dub. 8 sol.).

81. L.18, 534–542 (dub. 8 sol.). Compare Winter (1997, 183–84).

82. *Prouenit enim canities ex incorporatione fleumatis in superiori parte capitis, cuius incorporationis causa est diminutio caloris naturalis, et ista incorporatio et caloris diminutio semper fit et continue.* L.18, 537–539 (dub. 8 sol.). Trans. Thom and Scott.

That is, it is necessarily true that going grey is the same process as the incorporation of phlegm into the upper part of the head, and it is necessarily true that this process is occurring in living men, because this process is necessarily occurring on account of the loss of heat in the human body, where the fact that human bodies lose heat is either immediate or demonstrable on the basis of the fact that human bodies are alive.

In other words, the fact that men go grey may be demonstrated as follows:

1. Going grey holds of the incorporation of phlegm into the upper part of the head,
2. the incorporation of phlegm into the upper part of the head holds of men,
3. therefore, going grey holds of men.

Where (2) is demonstrable on the basis of a further demonstration such as:

1. The incorporation of phlegm into the upper part of the head holds of any body losing heat,
2. A body losing heat holds of men.
3. Therefore, the incorporation of phlegm into the upper part of the head holds of men.

Like Striker, then, Kilwardby thinks of a natural contingency as expressing an occurrence that is subject to interruption. But his reading differs from Striker's in that he does not take Aristotle to hold that the natural contingency is in any sense a necessity. The terms of the syllogism above may be understood in two ways, namely as denoting necessary natural processes or contingent natural outcomes. The predications are true and the syllogisms valid on either reading. But their modal status differs depending on what reading they are given. On the outcome reading, they are all true only for the most part and not necessarily. While the type of contingency expressed by "men (are in the process of) going grey" is a special one owing to its association with a necessity proposition that may be expressed using the same terms, it is still strictly contingent rather than necessary on this reading. Conversely, the reading on which the proposition is a necessity is a necessity

strictly speaking. It is a necessity in the sense of a hypothetical necessity delineated above. One is able to deduce from the very existence of a human that it is in the process of going grey, since an animal could not be a living human (according to Aristotle) without losing heat, and this process of losing heat is *ipso facto* the process that brings about greying if nothing prevents it. This is why there is only "roughly speaking"[83] a demonstration of natural contingency. Strictly what is demonstrated is a different, necessary proposition regarding the underlying process, which may, however, in at least some cases (such as this one) be expressed using the very same terms.[84]

This provides a powerful model for understanding the type of necessity that pertains to natural sciences in spite of exceptions. What the natural scientist studies is fundamentally natural processes. What must bracketed for the purposes of natural science is whether these processes in fact bring about their ends in any given case. Nevertheless, even if the natural scientist cannot make demonstrative inferences about whether a given instance of a process reaches completion, she can make demonstrative inferences about what processes must be occurring, given facts about the kind of natural thing she is studying and the processes that characterize its existence.

Putting this together with the foregoing, the following picture emerges. The scientist of sublunary life must discover necessities about goal-directed entities that neither necessarily exist, nor necessarily achieve their goals. This restricts the content of biological knowledge, but it does not rule out its possibility, nor does it mean that it is necessary only in a loose or weak sense. Demonstrations about biological *kinds* proceed in essentially the same way as any other demonstrative science, proving things about the kind and its species from the (teleologically specified) essence of that kind. The fact that members of such kinds may fail to achieve their goals means that their specification at the general level describes only

83. σχέδον, *Pr. An.* I.13, 32b.20. In the Latin translation he uses, Kilwardby reads *pene* (L.18, 165).

84. Cf. L.18,165–168.

what is (necessarily) good for the species as a whole or (necessarily) required for the life of any member of the species, not what each individual of the species necessarily does or how it behaves. This means that it can include only information about the *processes* that such creatures undergo, not about their actual state at any time.

As in other cases, the claim is not that we are unaware of facts about the individuals. It is rather that we know about them only in so far as they are members of their kinds. To say that Cuttie is alive is only necessary in the sense that blood is necessarily hot, that Cuttie *could not be* a cuttlefish (and thus could not be Cuttie) were he not alive. And since, in biology, the kinds to which they belong are specified in terms of processes that they engage in, the things that we may *know* about individual animals are only the processes they engage in, not their actual state. Ascertaining other facts about them must be the job of other cognitive faculties like perception, which have a greater share of cognitive work to do in the sublunary realm than in the study of superlunary or mathematical phenomena.

While this in some ways limits the scope of biology for Aristotle, it also highlights the concreteness of his idea of teleology. Animals having certain ends is not an abstract or projected feature of them; it is present in the concrete material processes that occur within them, processes that necessarily tend towards these ends even when they do not achieve them. Knowing the processes that characterize an animal's life is knowing something manifest in the very flesh that someone who dissects them touches. Just as to study triangles is to understand that one is studying something bracketing its changes,[85] so too to engage in the study of animals is to understand that one is as such studying something perishable in its process of becoming.

85. *Met.* Θ.10, 1052a.6–7.

## 5.4 Necessity and exceptions in natural and mathematical sciences

So far, I have been emphasizing that the necessity of what we know is a common feature of all scientific knowledge for Aristotle. Before closing, I wish to say something about the differences Aristotle sees between mathematics and natural sciences. I will not be able to fully defend the view I sketch here, but turning to this issue briefly will allow us to gain a better appreciation of what it means, for Aristotle, that natural and mathematical sciences are alike in having necessities as their objects.

For Aristotle, it is characteristic of mathematics that it studies its objects in abstraction from change. Aristotle goes to some pains to emphasize that this does not mean that mathematicians do not study ordinary, changing bodies or individuals. Instead, they study changing bodies at a level of abstraction that renders it irrelevant to their study as members of that science that they move.[86] In a certain respect, this is no different from any other science. Just as the physicist studies the motion of things that sometimes rest, so too the mathematician studies sensible objects in "abstraction"[87] from their sensible qualities. This licenses us to say that geometry is a study "*of* shapes" without thereby committing ourselves to the existence of "separate shapes alongside them [the sensible shapes]."[88]

That is, the mathematician studies changeless features of sensible things without thereby positing separate, changeless things. Aristotle likens the way that we may truly say that geometry is a science of shapes to the way that we truly say that human medicine is a science "of" (human) health, rather than of humans, the bearers of human health.[89] In calling medicine a science of human health, we do not commit ourselves to the existence

86. *Met.* M.3, 1077b.22–34.

87. *Post. An.* I.18, 81b.3, *De Cael.* II.1, 299a.16, *De An.* I.1, 403b.14–15.

88. *Met.* M.3, 1078a.4–5.

89. *Met.* M.3, 1077b.34–1078a.5.

of something like a Form of Health alongside healthy humans.[90] Human medicine studies humans "as" healthy. It does this by studying the nature and causes of humans being healthy. The fact that humans are sometimes sick does not impugn the possibility of such a study (indeed, it is its *raison d'etre*). The student of medicine must simply understand sickness for what it is in the context of her study: A privation of health, rather than one of its manifestations. In the same way, Aristotle urges, geometry studies sensible shapes, but "as" shapes, not "as" sensible particulars. That gives a sense to the locution "medicine studies health" or "geometry studies geometrical objects" without requiring there to be health, or geometrical objects, save *as* features of their respective subjects.[91]

In a certain respect, natural sciences too study things that are changeless. They study those features of the changing world that hold of necessity and are always true. Yet there is another respect in which natural sciences do not abstract from change. Aristotle associates a characteristic type of error with the attempt to study natural things abstracting from all change and matter as the mathematician does:

90. *Met.* M.3, 1077b.34–1078a.1.

91. Aristotle goes on to comment that "many" *per se* attributes hold of their subjects in this way (*Met.* M.3, 1078a.5–6), and he apparently wishes to include biology, since he mentions that a science is able to study properties that hold of animals *qua* male or *qua* female, and in this way studies maleness or femaleness *simpliciter*, without thereby positing a Form of Maleness or Femaleness. In doing so the science is studying *animals*; nevertheless, it is true also to say that a biologist studies maleness or femaleness, and this does not imply these are separately existing things.

**T69** They separate the objects of physics, which are less separable than the objects of mathematics. This is clear if someone tries to state the definition of each of these, and of their properties: Odd and even and straight and curved, as well as number and line and shape, can be defined without change, but flesh and bones and man cannot, and these things are spoken of just like snub nose rather than concave.[92]

If someone tries to conduct zoology by abstracting away the fact that an animal develops, or exists enmattered in a certain kind of flesh, the natural scientist has thrown out the baby with the bathwater. For the proper subject matter of natural science is *precisely* something *in its process of change*; something that *as such* exists as tending towards some outcome. This means that the natural scientist may not bracket certain facts of her subject matter as irrelevant in the way that a mathematician does. But nor does this mean that a natural scientist studies coincidences or *sheer* contingencies. For the fact that natural science studies things without abstracting from *all* change equally does not mean that it must study things taking into account *every* possible change that occurs in them. The fact that a dove, say, might be painted or have fallen in tar is no more relevant to the study of doves than the fact that a triangle in a diagram may be poorly drawn is relevant to mathematics.[93] Aristotle's reconciliation is to say that natural science studies *natural* contingencies, and to think of these as the observable contingent correlates of underlying necessary processes.

This does, however, introduce a certain methodological difference. For the fact that a natural scientist studies things *qua* changing means that it still does fall under the purview of a natural science to explain at least the *regular, law-like ways that natural processes*

92. τὰ γὰρ φυσικὰ χωρίζουσιν ἧττον ὄντα χωριστὰ τῶν μαθηματικῶν. γίγνοιτο δ' ἂν τοῦτο δῆλον, εἴ τις ἑκατέρων πειρῷτο λέγειν τοὺς ὅρους, καὶ αὐτῶν καὶ τῶν συμβεβηκότων. τὸ μὲν γὰρ περιττὸν ἔσται καὶ τὸ ἄρτιον καὶ τὸ εὐθὺ καὶ τὸ καμπύλον, ἔτι δὲ ἀριθμὸς καὶ γραμμὴ καὶ σχῆμα, ἄνευ κινήσεως, σὰρξ δὲ καὶ ὀστοῦν καὶ ἄνθρωπος οὐκέτι, ἀλλὰ ταῦτα ὥσπερ ῥὶς σιμὴ ἀλλ' οὐχ ὡς τὸ καμπύλον λέγεται, *Phys.* II.2, 195b.36–194a.7.

93. Cf. *Met.* M.3, 1078a.17–21, *Post. An.* I.10, 76b.39–77a.2.

*might fail*.[94] In mathematics, by contrast, since things are considered in abstraction from all change, the only relationships that it falls to the science to study are static ones between the essences of mathematical objects.[95]

This is why Aristotle can undertake in the *Generation of Animals* IV.3–4 not only to mention the possibility of birth defects but to catalog their kinds and explain their mechanisms. He explains, for instance, "the disease known as satyriasis, in which the face appears like that of some other creature–a satyr" as being due to the "quantity of unconcocted humor being diverted into parts of the face."[96] This does not represent any departure from the claim that natural science studies necessities. For it is a necessity that a creature that diverts too much unconcocted food to the face will not have the natural face of that type of animal,[97] this being essentially the face produced by the *correct* amount of *concocted* food being diverted to the face. The zoologist may assert this as a necessity while nevertheless bracketing questions about the precise conditions under which satyrism will occur (how much food is too much? how unconcocted can the food be?), questions which may perhaps have no general answers owing to the number of possible interfering factors the developmental process is subject to. It is thus possible for the natural scientist to account for certain *types* of interruption to a natural process even while bracketing the specifics of whether natural processes come to completion.

Aristotle takes this type of explanation also to be applicable to what I described at the beginning of this chapter as the more troubling type of exception, where an entire biological sub-kind represents an exception to what holds of it generically. In addition to mentioning the exceptional case of the blind mole, Aristotle goes on to *explain* why

94. A similar point is made in Sandstad (2016a, 74).

95. Cf. *Gen. An.* II.6, 742b.33–35.

96. τὸ νόσημα τὸ καλούμενον σατυριᾶν· καὶ γὰρ ἐν τούτῳ διὰ ῥεύματος ἀπέπτου πλῆθος εἰς μόρια τοῦ προσώπου παρεμπεσόντος ἄλλου ζῴου καὶ σατύρου φαίνεται τὸ πρόσωπον, *Gen. An.* IV.3, 768b.34–36.

97. ἀναγκαῖον, *Gen. An.*, IV.3, 767b.14.

the mole is blind yet belongs to an essentially sighted genus, telling us that the mole is a "stunted"[98] viviparid:

> **T70** there may exceptionally be a single kind which has become stunted, the mole, for example. This animal lacks the sense of sight: it has no visible eyes, but if the skin (which is thick) be removed from the head at the external place where eyes are normally, the eyes are found in an impaired condition, complete with all the parts belonging to genuine eyes: they have the "black," and that which is inside the black, the pupil as it is called, and the fatty part which surrounds it, but these are all smaller than in visible eyes. There is no external sign of these owing to the thickness of the skin, which suggests that in the course of development the natural process was stunted.[99]

Aristotle's explanation conforms to the interpretive assumption I am proposing, that a natural scientist only records the types of *processes* that take place in an animal's life and development. In certain cases, the natural processes leading to an animal's production may even be *naturally interrupted*, resulting in creatures like the blind mole. The blind mole counts as a member of a genus that is essentially sighted because its development includes a process that, if not interrupted, leads to the development of all five senses. But since the mole lives underground, it would be useless for the mole to have the power of sight. Eyes would give the mole a vulnerability on its head while providing no substantial benefit. Since nature does nothing in vain, the development of the mole's eyes is stunted, creating a sheath of immovable flesh in place of eyelids and setting the eyes far recessed. The mole nevertheless belongs to the genus of footed vivipara and has the characteristics

98. πεπήρωται, *Hist. An.* IV.8, 533a.2. On this passage compare the discussion in Sandstad (2016a, 76–77).

99. πλὴν εἴ τι πεπήρωται γένος ἕν, οἷον τὸ τῶν ἀσπαλάκων. Τοῦτο γὰρ ὄψιν οὐκ ἔχει· ὀφθαλμοὺς γὰρ ἐν μὲν τῷ φανερῷ οὐκ ἔχει, ἀφαιρεθέντος δὲ τοῦ δέρματος ὄντος παχέος ἀπὸ τῆς κεφαλῆς κατὰ τὴν χώραν τὴν ἔξω τῶν ὀμμάτων ἔσωθέν εἰσιν οἱ ὀφθαλμοὶ διεφθαρμένοι, πάντ' ἔχοντες ταὐτὰ τὰ μέρη τοῖς ἀληθινοῖς· ἔχουσι γὰρ τό τε μέλαν καὶ τὸ ἐντὸς τοῦ μέλανος, τὴν καλουμένην κόρην, καὶ τὸ κύκλῳ πῖον, ἐλάττω μέντοι ταῦτα πάντα τῶν φανερῶν ὀφθαλμῶν. Εἰς δὲ τὸ ἔξωθεν οὐδὲν σημαίνει τούτων διὰ τὸ τοῦ δέρματος πάχος, ὡς ἐν τῇ γενέσει πηρουμένης τῆς φύσεως, *Hist. An.* IV.8, 533a.2–12.

associated with this genus necessarily. Since its membership in this biological kind requires it only to undergo the relevant developmental processes, and not to complete them, this is compatible with there being no moles – or at least, no normally developed moles – that bring this process to completion and thus gain the ability to actually see.

The difference, then, between an exception like the blind mole and an exception like a poorly drawn triangle is that the mole's blindness admits of explication by recourse to biological principles. Both the mole's possession of eyes and its resultant blindness may be explained as an interaction of processes that naturally occur in footed vivipara for the sake of goods common to that whole genus and processes that naturally occur in the mole for the sake of that species' particular good. No such parallel explanation is available in the case of a sensible shape that fails to have some geometrical property.[100] The claim is not that such occurrences in geometry are *inexplicable*: One may, of course, explain the inequality of the lines of this equilateral triangle by pointing to a defect in the bronze or in the hand of the geometer who sketched it. But this is not a *mathematical* explanation, and, by the same token, the exceptional sub-class (poorly drawn triangles) is not a *mathematical* kind. The case therefore falls under the broad rubric of coincidence, not of science proper. By contrast, it is non-coincidental to being a blind mole that it defies the properties of its genus. There is nothing contradictory in asserting that blind moles *necessarily* undergo a process of development resulting in sight and necessarily undergo one which interrupts that process by growing flesh in front of the eyes, with the natural outcome being that they are blind. Yet this possibility only exists because moles are the types of beings which essentially undergo *development*, and the natural scientist differs from the mathematician in considering the mole *in* this developmental process rather than abstracting from it.

100. Cf. Sandstad (2016a, 86). We need not, following Sandstad, take this to imply that the objects of mathematical but not biological science are necessities (cf. also Sandstad 2016b). Strictly speaking, the biologist studies only the processes that necessarily occur.

## 5.5 Necessity and complexity: *Physics* II.9

Another difference between mathematics and natural science bears mentioning before closing. In *Physics* II.9, Aristotle writes:

> **T71** In a way, necessity among mathematical entities and necessity in those things that come about by nature is parallel. Since the straight is this, necessarily the triangle has two right angles, but it's not the case that since triangles have two right angles, a line is straight. Yet if a triangle did not have angles equal to two right angles, neither would the straight be this.[101]

Aristotle notes again here that in a certain respect the necessities that pertain to natural sciences and to mathematical sciences are alike. Explanation in both mathematics and natural science proceeds by tracing lines of necessity from principles. Aristotle describes a proof of the theorem that triangles have internal angles adding to the sum of two right angles that relies on the definition of "straight." Such a definitional statement is either a fundamental posit of the science of mathematics, or derivable from some fundamental posit.[102] On its basis, Aristotle says, it is possible to simultaneously deduce and explain why the triangle has this angle sum. That a triangle has 2R is thus shown to hold of necessity, because the definition of straight and any other principles employed are necessary truths. It is not only proven but *explained* in this way because the fact that a line has such-and-such a definition is prior in nature to the fact that a triangle does.[103] In like fashion, the zoologist simultaneously deduces and explains the facts about the parts, characteristics, patterns of development and changes that animals naturally undergo on the basis of the principles of zoology. Yet there is also a sense, Aristotle maintains, in which the case of

101. ἔστι δὲ τὸ ἀναγκαῖον ἔν τε τοῖς μαθήμασι καὶ ἐν τοῖς κατὰ φύσιν γιγνομένοις τρόπον τινὰ παραπλησίως· ἐπεὶ γὰρ τὸ εὐθὺ τοδί ἐστιν, ἀνάγκη τὸ τρίγωνον δύο ὀρθαῖς ἴσας ἔχειν· ἀλλ' οὐκ ἐπεὶ τοῦτο, ἐκεῖνο· ἀλλ' εἴ γε τοῦτο μὴ ἔστιν, οὐδὲ τὸ εὐθὺ ἔστιν, *Phys.* II.9, 200a.15–19.

102. See section 4.4.1.

103. *Post. An.* I.2, 71b.34–72a.4.

natural science is "reversed:"

> **T72** In things coming about for the sake of something it is reversed: If the end is or will be, then the prior thing is or will be: But if not, then just as [in the mathematical case] if the conclusion does not hold the principle will not hold, here, too, if the telos and that-for-the-sake-of-which.[104]

Whereas a mathematical proof deduces facts about the nature of triangles from the primitive facts about the nature of the primitive items in a science, the zoologist works backwards, deducing facts about what must hold of an animal given that it is to realize its end, or at least to survive as a creature with such ends. The material parts which work in unison to bring about its end do not, Aristotle maintains, *explain* why the animal has these ends. Instead, these must be explained by recourse to the facts about the goals of the animal, which Aristotle here identifies as the principles of the biological account.

Aristotle takes these facts about the goals of natural processes to be principles of the relevant biological science. Mathematics and biology are thus alike in that they explain by deducing facts about the proper objects of the science from principles of those sciences. This is what their parallel consists in. The difference lies in the type of items that count as principles in each case. In biology, the material make-up of a creature is posterior in the order of explanation, since animals are made of the matter that they are, and have the parts that they do, *because* they have certain ends and goals. The complex fact of an animal having a certain type of life thus forms an explanatory principle in biology, and is what grounds the facts about its parts and physical constitution.[105] In mathematics, on the other hand, the nature of more complex objects is explained by recourse to more basic, quasi-material components: The existence of points explains the nature of lines, the

104. ἐν δὲ τοῖς γιγνομένοις ἕνεκά του ἀνάπαλιν, εἰ τὸ τέλος ἔσται ἢ ἔστι, καὶ τὸ ἔμπροσθεν ἔσται ἢ ἔστιν· εἰ δὲ μή, ὥσπερ ἐκεῖ μὴ ὄντος τοῦ συμπεράσματος ἡ ἀρχὴ οὐκ ἔσται, καὶ ἐνταῦθα τὸ τέλος καὶ τὸ οὗ ἕνεκα, *Phys.* II.9, 200a.19–22.

105. Cf. Lennox (2010).

existence of lines the nature of triangles, etc.[106] Aristotle resists calling these "material" components, since he holds that mathematics abstracts from all matter, but he often presents them as playing an analogous role to matter.[107] These quasi-material components of mathematical objects stand to the objects they constitute in the inverse relation that a living organism's form of life stands to its natural parts and materials, in so far as the quasi-material components of mathematical entities *explain* the character of complex mathematical objects, whereas the material components of animals *get explained by* the character of the animals they constitute.

This may seem to stand in tension with the account I gave in the previous chapter, where I claimed that all necessity, for Aristotle, must derive from incomposite objects. But this tension may be alleviated by seeing that the sense of "simplicity" there is different from the sense of basicness of primitiveness at issue here. The sense of "simplicity," as Aristotle defines it in *Metaphysics* $\Delta$.5, is tied to explanation. The truths that are simple in this case are those which cannot be explained by anything more fundamental; the objects which are simple in that case are the things whose existence provides for these explanatorily basic truths. Here, Aristotle's distinction is one more closely tied to parthood or composition.[108] Aristotle's point is that in mathematics the explanatory principles are the quasi-material constituents and their *per se* attributes. The explanatorily basic parts of mathematical objects are also their constituents. In biology, material constituents are explanatorily posterior to the wholes that they constitute. The teleologically specified definitions of these wholes are prior in the order of explanation.

Another difference, then, between necessity in mathematics and biology concerns the

106. *Post. An.* I.4, 73a.35–37.

107. In addition to the previous note see *Post. An.* II.11, 94a.21–22, 24–35. Cf. Peramatzis (forthcoming). But see Malink (2017) for a different reading of this passage that does not take it to turn on the mathematical character of the example.

108. I will not venture any further claims about how this relates to the notions of priority Aristotle enumerates in other contexts. On this, see Peramatzis (2011).

relationship between these two forms of priority. In geometry, the parts of a triangle (lines) and their *per se* attributes explain the features that triangles can have. In biology, the parts an animal has, and their *per se* attributes, get *explained by* the needs of the animal, the complex whole to which they belong. In both cases, incomposites form the ultimate ground of demonstrative necessities. The difference is in what *count* as incomposite entities in the respective cases. In both cases, what is studied is a necessity.

# CONCLUSION AND OUTLOOK

I began by asking why Aristotle holds that we only know necessities. I have argued that this view is what allows Aristotle to consistently hold that knowledge is both a relative and a state. The notion that knowledge has the metaphysical status of a relative reflects the idea that our knowledge is of something genuinely other. It is something genuinely external to ourselves that we latch onto when we know about the world in the deep way that requires understanding demonstrations and definitions. It reflects, in other words, a kind of realism. The grammar of "S knows that $p$" is taken by Aristotle at face value to the extent that he thinks there is something in the world corresponding to $p$, and that we know it because we are related to it in the appropriate way. Rather than taking this to be a timeless proposition, however, Aristotle takes it to be a state of affairs that exists over time; an ontological structure that houses its components in a combined or divided state and provides for the truth of thoughts and utterances at the time of their being thought or being uttered.

The idea that knowledge is a state (*hexis*) reflects, on the other hand, a view of knowledge as stable throughout flux. Our knowledge is more valuable than belief precisely because it does not get swept up in the changes of the world around us, that it preserves its truth come what may (blows to the head and lapses of memory, of course, excluded). Underlying both of these ideas is the notion of knowledge as something that may be called upon and put to use; knowledge as the locus of an essentially repeatable capacity to judge and explain, perhaps descending from the word's original meaning as denoting practical skills or abilities.[109]

It is the fact that knowledge is of a necessity which allows it to be both of these things. Knowledge is stable and reliable while being tethered to the truth of its object, because the only things that we do know, strictly speaking, are permanently true.

109. See pp. 21–24 of the Introduction.

In so far as Aristotle argues that knowledge must be of something more "abiding" than belief, he is following a tradition. But Aristotle develops a conception of the necessities that underwrite known propositions in a way that distances him from what he takes to be the views of his predecessors.[110] For Aristotle, what it ultimately means for knowledge to be abiding is that we know the invariant aspects of the world around us. He develops a metaphysical scheme on which these are the broadly definitional[111] features of the object, features which are grounded in metaphysically simple truths. While such metaphysically simple truths may be reified and thought of as simple beings, knowledge requires no special "objects" in the sense of separate things that might serve as the subjects of permanently true predications. There can be *per se* necessities, and therefore stable knowledge, of the objects of our experience because the connections between certain of their features are invariant. The possibility of interruption of teleological natural processes narrows the scope of our knowledge of such processes to the fact of their occurring (as opposed to their completion), but it does not rule out the possibility of knowledge even in the study of animals.

From this perspective, Aristotle's claim that knowledge is of a necessity is best understood not as an early and ultimately untenable restriction of knowledge to a particular part of reality, nor as mere lip service to tradition. Rather, it is the kernel of a thoroughgoing attempt to explain how knowledge can be possible given shared anxieties about the possibility of knowledge of a world in flux. That knowledge is of necessities is a genuine alternative to saying that knowledge is about the Forms.

Properly understood, Aristotle's view does not imply that we are *ignorant* of anything but the necessary and the universal. It rather has the effect of dividing epistemic labour between knowledge proper and other faculties that employ, draw on, or make use of our

110. I have been careful to say nothing about whether they *really* are the views of his predecessors.

111. That is, *per se*$_1$, *per se*$_2$ or *per se*$_4$.

knowledge. To the extent that the content of knowledge is more bare, for Aristotle, the content of other mental states like perception and opinion must be richer, for it then becomes the job of other faculties to reliably provide the type of awareness that allows us to apply our knowledge in particular cases. It would be an interesting project to consider Aristotle's theory of perception, opinion or imagination in light of these results about his theory of knowledge.

The fact that for Aristotle knowledge is of states of affairs that are *permanently true*, I have argued, is to be sharply distinguished from the view that it is of states of affairs that are *timelessly* true. Aristotle holds that knowledge is of a state of affairs true at all times not because he holds, as more recent philosophers have, that states of affairs have their truth-values once and for all, but precisely because he does think of states of affairs as having different truth-values at different times, and hence must limit knowledge to those states of affairs whose truth is not prone to fluctuation. I have not defended Aristotle's view of time-dependent states of affairs, but I hope to have done enough to show that it is sufficiently coherent to serve as the basis of a rather complex scientific epistemology. Another interesting project would be to consider how the landscape of contemporary epistemology and philosophy of science look without the assumption that knowledge is of a timelessly true proposition or state of affairs, and to what extent a broadly Aristotelian view might be rehabilitated in either of those settings.

# APPENDIX: *EPISTĒMĒ* AS UNDERSTANDING

The purpose of this appendix is to defend my decision to translate *epistēmē* as "knowledge" and the verb *epistasthai* as "to know" against a proposal in the literature to translate these with "understanding." I will argue that both "knowledge" and "understanding" are imperfect translations, and liable to be misleading, but that the traditional translation as "knowledge" or "scientific knowledge" is ultimately preferable. For that reason I employ this translation while nevertheless conceding some of the points made by those who recommend "understanding" as a translation.

## A.1 Burnyeat's proposal

English translators have traditionally rendered *epistēmē* as "knowledge" or "scientific knowledge."[1] Myles Burnyeat, following Aryeh Kosman,[2] challenged this in an influential paper,[3] in which he suggested *epistēmē* ought instead to be translated as "understanding." Burnyeat draws attention to the fact that Aristotle requires someone with *epistēmē* of the kind principally under discussion in the *Posterior Analytics* to be in possession of a deductive explanation from first principles. Here is the key text, leaving *epistēmē* and the associated verb *epistasthai* untranslated:

> we say that there is *epistēmē* by demonstration. By demonstration I mean a syllogism which produces knowledge, and by productive of knowledge I mean that of which it holds that, in virtue of possessing it, we *epistasthai*. If there is *epistasthai* of the sort we have posited, it is necessary for demonstrative

1. Burnyeat (1981, 97–98) refers to Mure (1928). "Knowledge" is also employed by Grote (1872). Ross (1949, 51) argues for "scientific knowledge." See also my discussion in section 1.2 beginning on p. 7.

2. Kosman (2013b).

3. Burnyeat (1981).

> *epistēmē* to be from premises that are true, primary and immediate, and are better known than, prior to and explanatory of the conclusion[4]

Aristotle's claim here would not be reasonable, Burnyeat argues, if *epistasthai* meant "to know."[5] Knowledge requires justification, but this justification needn't take the form of a deduction, let alone an explanatory deduction from first principles. It seems unproblematic to say that I know *that* broad-leaved plants are deciduous, but I don't know why there are, or whether they might not have been. My justification for knowing that broad-leaved plants are deciduous might be that I have observed them to be so over many seasons, or that they are always sold in the "deciduous trees" section at the nursery, or that my friend the reliable botanist told me. Outside of sceptical scenarios, being able to cite something like this is sufficient for someone to count as possessing knowledge. Burnyeat puts it this way:

> Justification is expressed in argument to show that a proposition is true. The argument need not be deductive, and even if it is, it need not meet Aristotle's requirement of explaining from first principles why the proposition is true.[6]

By contrast, Burnyeat argues, these would be a reasonable set of conditions to place on understanding, since "explanation and understanding go together in a way that explanation and knowledge do not."[7] The other conditions – that the premises of a demonstration are true, primary, and immediate, and better known than and prior to the conclusion – flow from the more basic ideas that *epistēmē* requires having an explanation and taking the

4. φαμὲν δὲ καὶ δι' ἀποδείξεως εἰδέναι. ἀπόδειξιν δὲ λέγω συλλογισμὸν ἐπιστημονικόν· ἐπιστημονικὸν δὲ λέγω καθ' ὃν τῷ ἔχειν αὐτὸν ἐπιστάμεθα. εἰ τοίνυν ἐστὶ τὸ ἐπίστασθαι οἷον ἔθεμεν, ἀνάγκη καὶ τὴν ἀποδεικτικὴν ἐπιστήμην ἐξ ἀληθῶν τ' εἶναι καὶ πρώτων καὶ ἀμέσων καὶ γνωριμωτέρων καὶ προτέρων καὶ αἰτίων τοῦ συμπεράσματος, *Post. An.* I.2, 71b.9–22.

5. Burnyeat (1981, 99).

6. Burnyeat (1981, 101).

7. Burnyeat (1981, 102).

object of one's knowledge to be incapable of being otherwise.[8] Burnyeat concludes that what Aristotle is talking about here is not knowledge but rather understanding.[9]

In ascertaining what Aristotle *means* by *epistēmē*, we should be wary of drawing on Aristotle's theoretical pronouncements on the nature of *epistēmē*. For the fact that Aristotle gives a *theory* of *epistēmē* that makes central to it features we associate with understanding does not show that Aristotle *means* "understanding" by the word "*epistēmē*:" It may be that Aristotle means "knowledge" but has some *philosophical* reasons for taking knowledge to have the properties that we associate rather with understanding. Thus, contra Burnyeat, I believe we should not place too much weight on the fact that Aristotle consistently states that *epistēmē* requires knowing explanations. Even the fact that he reports this as something that all people think[10] is not good evidence that this is a part of the word's ordinary meaning, both because the extension of "we all" is unclear (it may mean "we philosophers"), and because people tend to be poor judges of the usage patterns of words in their own language. We are better served by the linguistic principle that John Lyons took in his study of the knowledge words in Plato, to "accept everything that the native speaker says *in* his language, but to treat with reserve anything he says *about* his language, until this has been checked."[11]

There are patterns in the usage of "*epistēmē*" which admittedly make it closer to "understand" than to "to know." Aristotle clearly sees *epistēmē* as a graded notion: We have *better* or *worse epistēmē* of things depending on the type of demonstration we possess.[12]

8. Burnyeat also argues that it is intuitive to take understanding to be of what cannot be otherwise. I argued against this in the Introduction. See section 1.2.

9. Burnyeat (1981, 104). He suggests there that γιγνώσκειν and γνωρίζειν are rather the terms which correspond to our concept of "knowledge," but he grants that these terms are sometimes synonymous with *epistasthai* (Burnyeat 1981, 106).

10. See note 23 on p. 3.

11. Lyons (1963, 140).

12. See *Post. An.* I.24–25, which argues that the best *epistēmē* is had on the basis of a universal and affirmative demonstration (see esp. *Post. An.* I.24, 85a.23).

Aristotle's definiendum in the passage above is *epistēmē* "without qualification" – that is, the type that suffers no intrinsic defects or flaws which would give us reservation in ascribing it to someone, no grounds for saying that someone has *epistēmē* only "in a certain respect." In English, understanding is more easily graded in this way than knowledge. We speak naturally about someone's understanding being better or worse, or of someone having a deeper or more superficial understanding of some topic. By contrast, we tend to think of knowledge as more of an all-or-nothing affair: Someone either knows $p$, or does not know it.[13]

In other respects, however, the grammar of the word *epistasthai* is closer to "to know." *Epistasthai* is naturally augmented, and its meaning modified, by so-called "wh-" words: Who, what, where, when, etc. Thus contemporary philosphers distinguish knowing-that and knowing-why; so too Aristotle distinguishes and discusses the relationships between *epistasthai* that, *epistasthai* why, *epistasthai* what and *epistasthai* whether.[14] The meaning of the word is modified by the following relative pronoun in a way that resembles the modification of "to know" in English: To *epistasthai* that something is to know it but not necessarily know the reason why, as to knowledge that might be distinguished from knowledge why. Aristotle makes use of this contrast in *Posterior Analytics* I.13. I again leave *epistēmē* and *epistasthai* untranslated:

> *Epistasthai* that and why differ, first in the same *epistēmē* – and in two ways. In one way, if the deduction does not proceed through immediates: In this case the primitive explanation is not assumed, but *epistasthai* the reason why

13. That is compatible with taking knowledge to be *context sensitive*, and so taking there to be some contexts in which the same proposition counts as known whereas others in which we would say that a person does not truly know it. In a given context, we still do not speak of someone knowing it *more* or *less* truly. We do speak of knowing a language better or worse, but in this case "know" takes on a meaning that is anyway close to "understand:" We speak almost interchangably of someone understanding the language better.

14. On the modification of "know" by wh-phrases, see Stanley and Williamson (2001).

> occurs in virtue of the primitive explanation. In a second way, if, although the deduction does proceed through immediates, it proceeds not through the explanation but through the more familiar of the converting terms.[15]

Here Aristotle distinguishes between two grades of *epistēmē* with regard to the same fact. Someone has *epistēmē*-that[16] when they grasp a syllogism that shows *that* something must obtain, but not *why*. To achieve *epistēmē*-why,[17] someone needs to grasp a syllogism whose middle term expresses the reason that explains why the conclusion obtains. As an example of what he means, Aristotle, contrasts two syllogisms about the planets:[18]

**Syllogism *that*:** What does not twinkle is near (premise), the planets do not twinkle (premise), therefore, the planets are near (conclusion).

**Syllogism *why*:** The planets are near (premise), what is near does not twinkle (premise), therefore, the planets do not twinkle (conclusion).

Since the planets' lack of twinkling is not what explains their being near (their non-twinkling does not *make* or *cause* them to be near), the first syllogism cannot impart *epistēmē* why, even though it is, by all lights, a valid deductive argument and hence *does* show *that* the conclusion must obtain.[19] On the other hand, since the planets being near *is*, Aristotle seems to be supposing, the reason why they do not twinkle, the person who grasps the second syllogism *does* have *epistēmē* why the planets do not twinkle.

15. Τὸ δ' ὅτι διαφέρει καὶ τὸ διότι ἐπίστασθαι, πρῶτον μὲν ἐν τῇ αὐτῇ ἐπιστήμῃ, καὶ ἐν ταύτῃ διχῶς, ἕνα μὲν τρόπον ἐὰν μὴ δι' ἀμέσων γίνηται ὁ συλλογισμός (οὐ γὰρ λαμβάνεται τὸ πρῶτον αἴτιον, ἡ δὲ τοῦ διότι ἐπιστήμη κατὰ τὸ πρῶτον αἴτιον), ἄλλον δὲ εἰ δι' ἀμέσων μέν, ἀλλὰ μὴ διὰ τοῦ αἰτίου ἀλλὰ τῶν ἀντιστρεφόντων διὰ τοῦ γνωριμωτέρου. κωλύει γὰρ οὐδὲν τῶν ἀντικατηγορουμένων γνωριμώτερον εἶναι ἐνίοτε τὸ μὴ αἴτιον, ὥστ' ἔσται διὰ τούτου ἡ ἀπόδειξις, *Post. An.* I.13, 78a.22–30.

16. ὅτι, *Post. An.* I.13, 78b.37.

17. διότι, *Post. An.* I.13, 78b.37.

18. *Post. An.* I.13, 78a.30–78b.4.

19. Cf. the definition of a syllogism at *Pr. An.* I.1, 24b18–20.

What is important to note here, for our purposes, is that Aristotle *does* take even the person who only grasps the first syllogism to have *epistēmē*, albeit only *epistēmē*-that rather than -*why*. Yet there can be little doubt that *epistēmē*-that is, for Aristotle, *epistēmē*.[20]

If we take *epistasthai* to mean "to know" when Aristotle distinguishes *epistasthai*-that from *epistasthai*-why in I.13, the passage makes good sense: Someone who grasps only the first syllogism *does* have knowledge of the fact that the planets are near, since she derives it from a syllogism that shows that it must be true, but she does not know the reason why, because the syllogism which she grasps does not have the real ground of this fact as its middle term.[21] But if *epistasthai* means "to understand," the contrast is harder to understand. As Burnyeat points out, we normally take it to be implied by the fact that someone understands something that they also understand the reason why. But that makes *epistasthai*-that a misnomer. Understanding "that" and understanding "why" do not form a natural contrast in English in the way that "knowing that" and "knowing why" do, and where they are contrasted, they do not capture the distinction Aristotle is making here.[22]

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20. This claim is not entirely trivial. Counterfeit legal tender is not legal tender nor is a rubber duck a duck. But being "of the fact that..." (τοῦ ὅτι) does not stand to "*epistasthai*" as "rubber" stands to "duck" or "counterfeit" to "legal tender." The latter are conditions which undermine the status of the thing as a member of its kind: Being rubber disqualifies any candidate object from being a duck, being counterfeit disqualifies any object from being legal tender. It is no part of being legal tender that it is counterfeit (quite the opposite). On the other hand, to ascertain *that* something must be the case *is* a part of *epistēmē* without qualification as Aristotle defines it in *Post. An.* I.2. For if we are to grasp the cause that explains some fact and that this fact cannot be otherwise, we must *inter alia* grasp *that* the fact obtains. Since, therefore, being of the fact is a necessary condition for *epistēmē* being of the reason why, it can be naturally understood as a less strict sense of *epistasthai* (but a sense of *epistasthai* all the same).

21. Cf. Patzig (1981).

22. When we do talk of "understanding that" in English we seem to be using it in a way that is not even factive: I might say "I understood you would not make it" to someone who unexpectedly shows up at dinner. So "understanding that" in this sense cannot be what Aristotle means by *epistasthai* of the "that" in *Post. An.* I.13, 78b.37, because that *is* a factive notion: It requires a sound (even if not necessarily explanatory) argument. Cf. Burnyeat (2011, 13).

Given that we know from *Post. An.* I.13 that Aristotle *does* take there to be *epistēmē* which is merely of the fact, and not of the reason why, it is more natural to read the passage in *Post. An.* I.2, where Aristotle clearly does take *epistēmē* to require knowing not just *that* something is so but also the explanation, as describing the conditions on an elevated kind of knowledge, rather than taking it to be a definition of a separate notion. This elevated kind of knowledge has higher standards than we might require in day-to-day speech, and some of these standards might be ones that English reserves for understanding. But we can admit that while denying that *epistēmē* just means "understanding" whenever Aristotle uses it. Indeed, we must admit that if we wish to make sense of *Post. An.* I.13 alongside I.2.

## A.2 Knowledge and explanation

I have shown that *epistēmē*, in at least one sense Aristotle gives it, does not presuppose explanation from first principles. If we keep in mind that Aristotle is talking about *unqualified epistēmē* in *Post. An.* I.2, then Burnyeat's way of driving a wedge between *epistēmē* and knowledge also becomes less convincing. For even if we grant that certain instances of *qualified* knowledge might fail to involve explanation, it is not clear that the same is true of unqualified knowledge, on Aristotle's theory. If we take Aristotle to be speaking about knowledge in I.2, then Aristotle's claim is that any knowledge which is not backed by an explanation of what we know from first principles is knowledge but not, as we might say, knowledge *unreservedly*. It is only in a qualified, partial or otherwise half-hearted sense "knowledge."

The reading I have given in this dissertation shows why Aristotle ought to hold this. For I have argued that at least one of the roles of demonstration is to act as a guarantor that one's *epistēmē* does not cease to be *epistēmē*. If one can prove something from first principles that are independently known to be necessary, then it follows that what one

knows is necessary in the sense, among others, that it will not cease to be true. That means that one will not lose one's *epistēmē* on account of a change in the object, because it guarantees that the object of one's *epistēmē* is not liable to change in truth-value.

As I noted in the Introduction, this is a plausible condition for anyone to place on *knowledge*. It is not that contemporary philosophers think that knowledge *can* change from true to false, it is rather that they need place no such requirements on the modal status of the objects of our knowledge because they tend to think of the objects of knowledge as timelessly true propositions. Given Aristotle's alternative way of thinking about the contents of knowledge as variable states of affairs, substantive restrictions are required to rule out cases where knowledge that is liable to fluctuate without any cognitive failure.

Aristotle's idea when he claims that unqualified *epistēmē* requires its object to be incapable of being otherwise and proven from first principles may therefore be that any knowledge which does not meet these standards is knowledge alright, but only in a qualified or secondary way, because it is not *guaranteed* to remain knowledge.[23] Knowledge that is of something contingent is only in a qualified sense knowledge because this knowledge will not be objectively durable,[24] and knowledge for which someone lacks a demonstration of its necessity is only knowledge in a qualified sense either because it will fail to be subjectively stable, or because even if it is objectively stable we may not know that it is.

Since there is reason for Aristotle to take unqualified *knowledge* to require a demonstration from first principles, this cannot be used as evidence that Aristotle *means* understanding by *epistēmē*. Further, if we translate it this way, we risk missing the possibility that his reasons for placing these restrictions are reflective of a distinctive philosophical theory rather than simply reflective of the way that he intends to use the term. I therefore think that knowledge is a safer translation, since it at least avoids the appearance of

23. Compare Hintikka (1973, 75).

24. See section 2.1.2.

deflating what I have argued ought to be viewed as a substantive philosophical thesis. If a translation makes Aristotle's claim that knowledge is of necessities initially surprising, this is as it should be.

## A.3 Further doubts about *epistēmē* as understanding

We may also take issue with Burnyeat's claim that "understanding" is less likely to be misleading as a translation. Here it is important to take into account the audience for whom Burnyeat was writing. Burnyeat presupposes that his reader will follow the "traditional analysis of knowledge as justified true belief."[25] His claim is only that *epistēmē* is "not knowledge as knowledge is standardly conceived in philosophy,"[26] taking this standard conception to be one of justified true belief (JTB).

Since the time of Burnyeat's paper, the landscape of epistemology has broadened, and it would be presumptuous now to refer to the JTB analysis as what every contemporary reader will presuppose. Different analyses have come on the scene, and there is now dispute over what even should constitute the canonical cases. In particular, the last twenty years have seen the growth of *virtue epistemology*.[27] This view, like Aristotle's, conceives of knowledge as intimately tied to intellectual virtues, requiring capacities that transcend particular judgements. It would be an interesting project to consider the ways that contemporary virtue epistemology differs from Aristotle's epistemology, but the differences, I expect, would be subtle rather than one of topic.

Further, in the intervening time, understanding has become an important and highly theorized concept in epistemology.[28] Yet the concept of understanding that contemporary

25. Burnyeat (1981, 101).

26. Burnyeat (1981, 102).

27. See note 20 on p. 2.

28. See, for example, Kvanvig (2003), Pritchard (2014), Elgin (2007), Grimm (2006), de Regt and Gijsbers (2017) and Ammon (2017).

epistemologists tend to focus on is a far cry from Aristotelian *epistēmē*, and this makes "understanding" at least as liable to be misleading to contemporary philosophers as a translation. In the contemporary literature, knowledge and understanding are often analyzed as distinct mental states, neither one of them requiring the other. On the one hand, it is generally accepted without argument that knowledge does not require understanding. On the other hand, there is a widely accepted argument in the literature to establish that understanding, conversely, does not require knowledge. I will give a version of this argument here.

Imagine that someone learns all about some topic – evolution, say – from a factually accurate and comprehensive textbook. She obtains the textbook by going to the library and picking the first book on evolution that she sees. The person studies the textbook thoroughly, and subsequently is able to give correct answers to a wide range of questions on the topic of evolution. On this basis, we say that the person possesses understanding. But suppose now that the library from which she drew her textbook was not a very good one. Terrible, in fact. Every textbook apart from the one which she happened to lay her hands on was a work of quackery, or a well-meaning book full of factual errors. The person, let us assume, would have been taken in by any of these other books, and, had she studied one of them, would have ended up with predominantly false beliefs about evolution rather than the true ones she in fact has. As a result, the person doesn't *know* any of the things that she learns – she merely happens to have true beliefs about them.

The sort of moral drawn from these considerations is typically the following. What is essential to knowledge is a relationship "between mind and world."[29] In particular, knowledge requires one to be cognitively related to the world in such a way that one has a "non-lucky" true belief: That one would not have the belief one in fact has, had things been different. Knowledge therefore "tracks" and is tethered to states of affairs holding in the

29. Kvanvig (2003, 197).

world. Understanding, on the other hand, is not outwardly directed in this way. Instead, understanding requires only "grasping the coherence-making relationships in a large and comprehensive body of information."[30] To say that someone understands is only to give a positive evaluation of the *internal* structure of her cognitive states: To say that her beliefs have the "right kinds of relationships" to one another.[31]

This type of view proposes a division of labor between knowledge and understanding. Understanding is an internal measure of the coherence of someone's beliefs. Securing reliable agreement with something non-mental is delegated to knowledge alone. Yet it is clear that Aristotelian *epistēmē* is not concerned merely with the internal coherence of our beliefs. As I discuss from the second chapter onwards, Aristotle conceives of *epistēmē* as a *relative*. The achievement of the relevant intellectual virtue represents not just the attainment of coherent beliefs, but a correspondence with an objective, extra-mental state of affairs.

Certainly this is not the only conception of understanding a philosopher might theorize,[32] nor is it the only one discussed in the contemporary literature. But if our concern is to find the term that *contemporary philosophers* will find least misleading, it is not clear that understanding still has the upper hand that it might have had at the time of Burnyeat's writing. How, then, should we understand and translate *epistēmē* as Aristotle uses it? The two questions are separate, and the first more important than the second. Aristotle's

30. Kvanvig (2003, 192).

31. Kvanvig (2003, 193). Kvanvig nevertheless maintains that understanding is factive, but others have denied this: See Baumberger, Beisbart, and Brun (2017, 7–10).

32. Burnyeat (1981, 107n.22) himself admits that the hermeneutical tradition stemming from Dilthey draws a *distinction* between "understanding" (*Verstehen*) and "explanation" (*Erklären*). This tradition associates "understanding" with the study of human and social phenomena, taking "explanation" *rather* than "understanding" to be the characteristic goal of the natural sciences. And among the German Idealists, understanding (*Verstand*) was contrasted primarily with reason (*Vernunft*), in such a way that the latter tends to pick out the more systematic and comprehensive notion. These both get at quite different notions of understanding from Burnyeat's one, which is drawn from analytic philosophy of science.

*epistēmē*, at least the unqualified version that Aristotle cares about most, may be thought of as a type of understanding that requires knowledge, or as a type of knowledge that requires understanding. On the whole, however, the traditional translation as "knowledge" still seems to me less misleading, for the reasons I have discussed.

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